RAILROAD GAZETTE

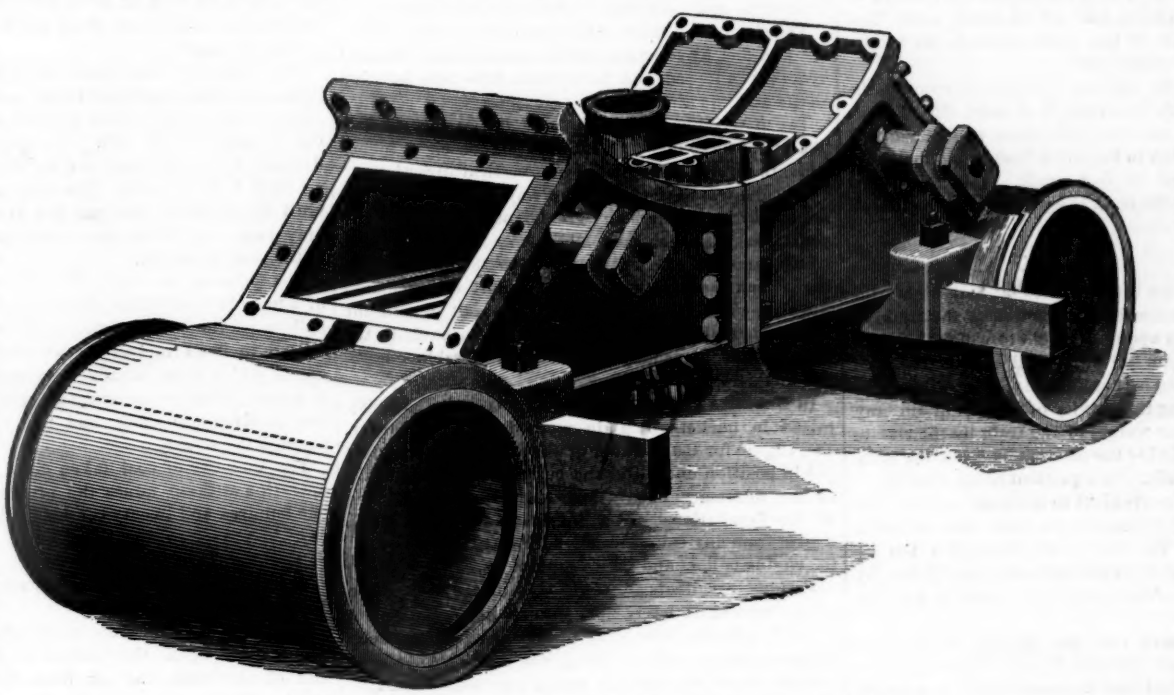
A Journal of Transportation, Engineering and Railroad News.

QUARTO VOL. II.—NO. 26. Fourteenth Year. | CHICAGO, SATURDAY, MARCH 25, 1871. | $4.00 PER ANNUM, In Advance.

COMBINED CYLINDER, STEAM-CHEST AND BED-PLATE.

The fact that no railroad company can make money by carrying its own iron over its own road, and then back again, is gradually forcing itself to be believed even by conservative men, who are in the habit of boasting that they "never try experiments." That only about 40 per cent. of the weight of a locomotive and tender is carried on the driving wheels, and that the adhesion due to this amount of weight is the "best hold" an ordinary engine can have to the track, is a fact of considerable significance, if we reflect that it costs as much to carry a ton of non-paying as it does to transport the same weight of paying load. Therefore, any effort looking to a reduction of dead weight is worthy of consideration.

The engraving herewith represents a mode of constructing the cylinders, bed-plates and steam-chests of locomotives, by which, the inventor claims, the weight of these parts will be reduced 2,000 lbs., with the additional advantages of greater simplicity and less exposure of the steam to loss of heat from radiation. We will, however, quote the description and claims of the inventor himself:



Combined Cylinder, Steam-Chest and Bed-Plate for Locomotive Engines.

"Locomotive engines as at present constructed, have about one-third of their total weight resting on the four wheels of the truck; this, in a 16x24-inch cylinder, eight-wheeled truck engine, would be 9¾ tons. Now, as half of this weight would be sufficient for all practical uses, if a reduction in this can be made, as well as a reduction of steam joints, thus working dryer steam with less loss of heat from radiation, a most desirable end is obtained.

"In the engraving we give a good idea of the improvements for which the inventor claims the above results. The bed-plate and the cylinder are cast together, and the steam-chest is formed inside the bed-plate and connected with the cylinder. Thus placed, and so formed as to be easily fitted and repaired, and perfectly protected by the smoke-box, steam is taken in at the top, and the only joint made is with the flat lid of the chest; all the fittings of the steam-chest, as now made, and connections are done away, and the chest, being completely housed by the hot smoke-box, there is very little change of temperature from the boiler to the cylinders. The bed-plate in cross section shows a perfect box-girder, light and strong, and the weight of these parts altogether is some 2,000 lbs. less than in the usual construction. Engines on this plan which are in use are models of simplicity and are economical.

"Further information and working drawings may be obtained by application to the inventor, Mr. Wm. S. G. Baker, No. 87½ North Charles Street, Baltimore, Md."

—The earnings of the Central Pacific Railroad in February, 1871, were $481,085; in February, 1870, $394,176—increase, $86,909. For the first two months of 1871 the earnings were $1,017,538, and for the first two months of 1870, $807,280—an increase of $310,303.

Contributions.

SIMPLE RULES FOR LOCOMOTIVE ENGINEERS AND MACHINISTS.

[Continued from Page 478.]

Considerable space has been occupied in the last two numbers of the GAZETTE, in urging the advantages, to engineers and others, of a knowledge of mechanical principles, and of the rules and operations necessary for estimating mechanical and geometrical results. I might have said more—and have been, perhaps, more forcible in my arguments, for I believe the subject wears new aspects in different lights, and the attention is best secured to the rules themselves, when their application and advantages are well illustrated. We might go back to Lord Bacon's maxim—"Knowledge is power," and trace, under different social conditions, and at different times, the value and power of knowledge in practical departments. It does not require argument, although it sometimes requires a very strong appeal to the attention, to convince a sensible man of the benefits of knowledge in his own particular business. Every operative engineer, if he can be persuaded to give proper attention, sees readily that other men's brains have been the foundation of his business; that within his own recollection the locomotive has been most wonderfully improved, and that, in the hands of thinking and working men, it is still improving every year.

If our engineer has ambition, he will naturally wish to assist in the improvement—to distinguish himself as one whose efforts have contributed to this steady advancement to perfection. His habits, associations, and obvious interests, all qualify him to stand in the ranks of useful discoverers and improvers if he so wills it.

But the tools with which his brains must work are the subjects of my articles, dedicated to his attention. Should he fail to perceive the laws of mechanical forces, or the relation of numbers, he might be no better off than the blind followers of perpetual motion. A familiar knowledge of technical subjects enables the eye to detect and the mind to comprehend the advantages or disadvantages of any system of machinery, or of any application of physical power. Without such knowledge our engineers must remain prejudiced and unable to step beyond blind habits and associations. I am by no means disposed to doubt that the class to whom these articles are addressed would gladly avail themselves of instruction in the very subjects which we have indicated. But how are they to obtain it? Who is to become the teacher? What means are in existence for supplying their wants? We must confess that there are none generally suitable to their wants. A tedious manual of formulæ, half algebra, and dry as a set pleading in law, is all the engineer or machinist can get hold of. If he has indomitable patience and energy, he may make something out of it; otherwise he remains profoundly ignorant. It is true enough that every principle ever discovered in mechanics, and every demonstration known in geometry, may be had in such works, but its rugged appearance, in a stiff mathematical treatise, does not suit the eye of the working man. I assume nothing in saying that few operative engineers know how to calculate the power of gravity, or the tendency to roll down hill on a "grade" or incline. A grade or inclined plane is in itself, however, one of the simplest mechanical "powers." Whether existing as a wedge, as a sloping plank on which a wheelbarrow is trundled up to a "landing," or as a railroad grade, as the winter coasting ground of the school boy, as the sloping face of an earth wall, or any other inclined way, or surface, the same principle applies in the calculation of the gravities of all bodies standing or moving upon all such ways or surfaces.

The result, in ascending any incline, is not only to advance but to rise to a higher level. Two motions are combined together, a horizontal and a perpendicular motion. This motion involves, or is subject to, all the ordinary friction of horizontal motion, and the weight or gravity belonging to a certain lift, or rise, besides. The two resistances are entirely independent of each other, and could a car of any given weight be made to move with but one-tenth of the power now required on a level, it would still have all the gravity it now has on any given grade. Every pitch of grade has its inevitable gravity, and as railroad tracks and railroad cars are now made, a grade of, say, 20 ft. per mile opposes a gravity equal to the ordinary resistance of friction at very slow speeds on a level. If, then, any one should tell us he had an improvement which would save *one-half* the power of draught of locomotives, even on 40 or 50 feet grades, we could set him down as a decided humbug, as such saving, at speeds of less than 15 miles an hour, would be mechanically impossible. Such is the independence of gravity from other resistances. I may now state another fact relative to gravity on slopes or grades. Its resistance is exactly proportioned to the steepness or "pitch" of the grade. One grade of 40 feet per mile presents twice the resistance of gravity of another of 20 feet per mile. This fact is a consequence of the law of gravity, and follows as a deduction from the rule I shall give for its calculation. I choose, however, to state it thus by itself, that it may not be overlooked.

To come, then, to the illustration of gravity on inclines: Power usually implies motion and may be un-

derstood as weight or pressure in motion. Power is thus not only greater as the weight or pressure is greater, but is greater also as the motion is more rapid. It may, therefore, be measured by the product of the weight and velocity—that is by so many pounds multiplied by so many feet per minute. A light weight at a great velocity may thus have the same power as a heavier weight at a slower velocity. But as two equal "powers' are thus supposed, the one *acting* upon the other may be called the "power," and the one *acted* upon, the "resistance." On a railroad grade, therefore, the power is the locomotive, and the resistance is the gravity of the train.

Some sharp engineer will say, "All this illustration "does not help the matter, as the engine and train, "moving together, move at the same velocity." True, they move at the same velocity forward, and they also move at the same velocity upward, but the motion forward and the motion upward are two things. If the grade be 80 feet to the mile, the train moves forward 66 times as fast as it moves upward; as by going forward 5,280 feet in rising 80 feet, it must go forward 66 feet to rise one foot. This is the *purchase*, then, which the engine has to lift the train. Although a powerful engine may move 1,500 tons, it cannot lift, at the most, seven or eight tons directly, by pulling over a pulley upon a dead weight. Fifteen tons hanging over a pulley would pull the most powerful locomotive in the United States, against its own steam, and four tons would be enough for the power of ordinary engines. And yet the engine which carries a train up an 80 feet grade has lifted it 80 feet perpendicular, even if the weight of the train be 200 tons. After deducting from the power of the engine the friction of the train, the remainder will lift as much more than itself as the length of the grade exceeds its height. The result may be stated thus:

If the power of the engine, beyond overcoming the friction of the train, is equal to a dead lift of three tons, at ten miles an hour, this same engine will lift 198 tons 800 feet high in the same time, which height is equal to 10 miles of 80 feet grade. For three tons moved 10 miles (52,800 feet), is equal to 198 tons moved 800 feet. Thus

3 times 52,800 are	158,400
198 times 800 "	158,400

If the principle is not thus detected at first sight, the learner must forget the forward motion of the train, as the gravity depends upon the height to which the train is lifted, and not upon the horizontal distance that it runs. The following is therefore the

Rule 1, for finding the gravity of the train on any grade: Multiply the weight of the train by the rise in feet per mile, and divide the product by 5,280, the number of feet in one mile. The quotient is the gravity.

Note.—It is most convenient to have the gravity obtained in pounds of resistance for each ton of train. Multiply, therefore, the number of pounds in a ton by the height of the grade in feet per mile, and divide by 5,280. The quotient is the gravity in pounds per ton on a given grade.

By using the above rule the gravity of one ton on a grade of one foot per mile, the result could be reserved to be multiplied into the number of feet per mile in any other grade, to find the gravity on such grade.

Rule 2.—Multiply the decimal .4242 which is the fraction of a pound gravity of one ton of 2,240 lbs. on a grade of one foot per mile, by the rise in feet per mile. The product is the number of pounds gravity of one ton of 2,240 lbs. on that grade. For tons of 2,000 lbs. multiply the rise in feet per mile by .3787, and point off four places for decimals. The product is the gravity in pounds on that grade.

Example.—What is the gravity of a train of 216 tons on a grade of 76 feet per mile? and how much per ton of 2,000 lbs.?

(By Rule 1) 216 tons are 432,000 lbs.
76 feet per mile.
5280) 32,832,000 (6,218 lbs. gravity.
Equal on 216 tons to 28¾ lbs. per ton.
(By Rule 2.) .3787 lbs. per ton per foot per mile.
76 feet per mile.
28.7812 lbs per ton, on a grade of 76 feet per mile, or 28¾ lbs. nearly as before.

The load which can be carried on any grade with a given power is inversely as the rise of the grade, leaving out all consideration of the friction of the load, or by first deducting from the power the amount neccessary to overcome the friction. F.

Laying out Railroad Curves.

To the Editor of the Railroad Gazette:

In your excellent Railroad Gazette of March 11, you have published a formula for laying out railroad curves, in which I find some errors (probably typographical) that might perplex and possibly mislead *young* engineers. I therefore submit the following correction:

The expression "$\frac{2x}{1=x^2}$" should be written $\frac{2x}{1-x^2}$.

The equation "$(2R-p)x^2-2dx=-p$" is correct, and is readily obtained as indicated. By dividing this equation by the co-efficient of x^2 and completing the square and extracting the root, in the usual manner, we get,

$$x=\frac{d\pm\sqrt{d^2-p(2R-p)}}{2R-p}.$$

This result (which any algebraist can readily verify), it will be seen, differs materially from the published formula. Suppose, for example, that $R=2$, $d=4$ and $p=3$, which is about the relative proportion of these quantities as represented in the published diagram. Then is $x=\frac{4\pm\sqrt{16-3(4-3)}}{4-3}=4\pm\sqrt{13}$; whereas, by the published formula we should have

$$x=\frac{4\pm\sqrt{16+9-12}}{4-6}=-2\pm\tfrac{1}{2}\sqrt{13}.$$

J. E. Hendricks.

Des Moines, Iowa, March 15, 1871.

Coal Mining at the Wilmington Mines.

[Read before the Civil Engineers' Club of the Northwest, by A. Comstock, of Joliet, Ill.]

The Wilmington coal mines are situated on the line of the Chicago & Alton Railroad, fifty-eight miles from Chicago.

The coal is found at a depth of from seventy to one hundred feet from the surface, and the vein is from three to four and a half feet in thickness.

The materials overlaying the coal are sand, clay, sand-stone and soap-stone, in variable proportions.

The size of the shafts varies somewhat in practice, but five feet by fourteen, inside measurement, is most generally adopted, and is divided into two hoisting shafts and one air shaft.

The material used in curbing or lining the shaft is oak plank three inches thick and six or eight inches wide, the width being placed in a vertical direction.

The greatest obstacles in the way of sinking a shaft are experienced where any great depth of sand is to be penetrated. In such cases a crib from eight to twelve inches larger in every direction than the inside curbing is sunk through the sand and a short distance into the clay. The inside curbing is then put in, and the intervening space puddled with clay to exclude the water, which is usually found in considerable quantities in this sand.

In sinking a shaft the materials excavated are usually raised in buckets by a gin worked by horse power. The engine for the working of the mine is not generally put in position until after the completion of the shaft, as the necessary excavation may cause a settling of its foundations or a total loss of the shaft, which, from any cause, would necessitate a removal of the engine boilers and their foundations.

Various expedients are resorted to in penetrating the sand. At a shaft lately sunk through about thirty feet of sand, a dredge, consisting of iron scoops or buckets, worked upon an endless chain, was used successfully.

Each one of the cages in which the coal is raised to the surface, consists of two platforms a little smaller than the hoisting shaft, one serving as a top and one as a bottom to the cage, which are supported at a distance of about six feet from each other, by suitable rods at the corners. Two guides extending from the top to the bottom of each hoisting shaft, and fitting in grooves in the sides of the cages, keep them from striking against the sides of the shaft while in motion. The cars are kept from shifting position while on the cage by a notch in a horizontal bar, which catches the axle and is kept at a proper height by a spring.

The cages are raised and lowered by a wire rope passing over a pulley, and thence around a drum worked by the engine. One cage is raised and one lowered at the same time.

The coal is mined upon the plan denominated "long wall work." Upon this plan all of the coal is removed, and the old workings allowed to close up, as hereinafter described. The first mine that was opened at this place was at first worked upon the "room and pillar plan." That is, rooms were turned off from the main entries and worked out nine yards wide and fifty yards long. A pillar nine yards in thickness was left between each two rooms. Upon this plan, but one-half of the coal was got out. There are none of the mines worked upon this plan at present.

When the shaft is finished, an entry is driven in opposite directions from the shaft to a distance of about thirty yards, or far enough to insure the engine and other works from being disturbed by the settling consequent to the removal of the coal. The entry is then driven entirely around the shaft, keeping at a proper distance therefrom, and a track is then put down connecting with the shaft. This forms the first cross road. The coal upon the outside of this cross road forms the working face, and is divided into portions, called "rooms," of sixteen yards each, and two miners are assigned to each room. As the face of the coal recedes from this cross road, a switch is put in, leading directly through the center of each room.

After proceeding a certain distance, the "squeeze" occurs, as the miners call it. That is, the whole superincumbent mass from under which the coal has been removed, gradually settles down and entirely closes the cavity made by removing the coal. As the squeeze comes on gradually, the miners maintain the proper height to their roads by taking down a portion of the top and stowing the material away in the cavity made by removing the coal. These old workings so filled in constitute what the miners denominate the "gob." After prosecuting the work in this manner until the length of the side tracks become too great for convenience, or their aggregate length is burdensome to the company, a new cross road is established along the face of the coal, and the track in the first cross road and all of the side tracks are taken up and the roads abandoned. A main road or entry is constructed to intersect the second cross road. The rooms are then reallotted and the mining proceeds as before.

Until the squeeze occurs, it is necessary to undermine the coal and to break it down with wedges, though powder is sometimes used to a limited extent. After the squeeze occurs, when the coal is undermined, the pressure from above soon causes it to break down.

The roads in the mines have a gauge of three feet, are laid with iron of about twelve pounds per yard, and the cars will carry from eight to fifteen hundred pounds of coal.

The miners of each room are furnished with checks containing the number of their room, one of which is placed upon a hook upon the bottom of the car. The car is then loaded with coal, taken to the surface, dumped into a railroad car, weighed, and the amount credited to that room. The cars are pushed by men until the distance becomes too great; they are then only pushed out to the main entry and are then drawn to the shaft by mules.

The building necessary for the convenient working of a mine is of sufficient size to contain the engine and boilers at the back of the shaft, and extending far enough in front to include two railroad tracks, upon one of which a car stands to receive the lump coal as it passes from the screen, and upon the other track a car receives the slack and fine coal which passes through the screen.

The quantity of coal taken from the five shafts in operation at these mines the present winter has been one hundred and twenty car loads of ten tons each per day.

Ventilation.

The ventilation of the mines is accomplished in four different modes:

First, by the natural ventilation. When the temperature upon the surface is much lower than that of the mine, the air from the surface, on account of its greater density and consequently its greater weight, falls down the hoisting shaft, and the warmer and lighter air contained in the mine rises through the air-shaft. By means of suitable doors, the current of air thus produced is controlled and directed through the entire circuit of the works and back to the air-shaft, bearing along with it, if it moves with sufficient velocity, the noxious gases, and supplying that indispensable requisite to the miner, namely, pure air. When the temperature at the surface is greater than in the mine, this mode of ventilation ceases to operate.

Mechanical appliances are then resorted to. The second method is by a furnace located in the mine, the heat of which rarifies the air, and causes a current upward through the air-shaft. The loss of air thus sustained in the mine is supplied by a current leading down the hoisting-shaft, which is directed and controlled in the same manner.

This mode is objectionable on account of the liability of setting fire to the wooden lining of the shaft.

The third method of ventilation is by discharging a jet of steam into the air-shaft, thereby causing an upward current of air.

The fourth method produces this current by means of a fan or blower operated by the engine.

The subject of ventilation is one of the most important connected with the working of mines.

Drainage.

Mines differ greatly in the amount of water which comes into them. In order to drain one economically, it is necessary to have the shaft sunk at the lowest point of the coal. This can only be determined by sev-

eral borings being made in the vicinity of the proposed shaft.

When the shaft is finished, a well or "sump" is dug at the bottom, from ten to twenty feet deep, and the water from the mine is drained into it, whence it is carried to the surface by means of a pump. Various expedients are resorted to in order to carry to the "sump" water that accumulates in depressions, that cannot be readily or cheaply drained by gravity. Water cars are much used to convey small quantities, but where any considerable quantity is found, a pipe is laid directly to the pump.

Cost of Repairing Rails by Baines' Rolls.

At a late meeting of the Engineers' Club of the Northwest, Mr. Charles Paine, Chief Engineer, read the following paper, entitled, "Statement of the Cost of Repairing Rails by 'Baines' Patent Rolls' at the Elkhart Shops upon the Lake Shore & Michigan Southern Railway in the year 1870."

Dr.

For fire clay, 27½ tons	$155 00	
" " brick, 9,240	415 93	
" " sand, 40 7-10 tons at $5 per ton	203 56	
" coal, 1,300 tons at $3.81 per ton	4,948 83	
" coke, 250 bushels at 10c per bush	25 00	
" patent iron, 373,700 lbs. at $80 per ton	9,774 52	
" old fish plates, 156,800 lbs. at 2c per lb	3,136 00	
" oil for the saw	2 70	
" repairs, (chargeable to rails, proportion)	1,000 00	
" labor	16,452 48	$36,114 02

Cr.

By rail-cuttings sold	$8,093 41	
By balance for repairs of rails	28,020 61	$36,114 02

Mem.

Rails repaired at one end, 9,439 = 9,439 ends.
" " both ends, 21,334×2 = 42,668 "
" " center, 8,572 (6=16) = 14,287 "
= 66,394 ends = 42.2 per end.

Total rails repaired, 32,854 = 85 2-10 cents for each rail.
" inches repaired, 1,112,324 = 33 8-10 inches per rail.

The foregoing account includes everything but charges for freight upon this road, for which no charge is made. The item of labor includes all cost of receiving, handling and sending off mended rails, for loading the scrap rails, which are assorted from those sent in to be repaired, and for unloading all the materials of various kinds required in the works. A small sum only is charged for oil, the whole quantity used for the shafting, etc., having been charged to the other departments of work, for which the greater length of shafting is employed.

"Repairs of Rails" account would be entitled to a a credit for work done for these other departments, if the amount could be readily computed, since the engine supplies wind for the four cupolas of the foundry, and for the blacksmiths' fires, also for the power for cleaning castings, for revolving the cinder-breaker, for the drilling and bolt-cutting of the blacksmiths' shop; the steam hammer is also used for other work than drawing down the patches.

Under these circumstances, the account shows rather worse for the rails than it ought, but I have preferred to treat the estimates of cost as if the shop were an independent one, for the purpose of comparison with others.

CHARLES PAINE.

CHICAGO, February 15, 1871.

Putting in Frogs and Switches.

We have received from Mr. C. Latimer, Engineer of the Chicago & Michigan Lake Shore Railroad, the following table and formula for putting in frogs and switches. Many of our readers will at once recognize its value:

TABLE FOR PUTTING IN FROGS AND SWITCHES—GAUGE 4 FT. 8½ IN., MOVEMENT OF SWITCH RAIL 5 IN.

Proportion of the mouth to the length of frog tongue	Frog angle	Degree of curvature	Radius of curve, feet	Distance from heel of switch to point of frog, feet	Length of switch rail, feet	Middle ordinate constant
1 to 4	14° 15′	37° 30′	155.6	38	11.5	14.
1 to 5	11 25	23 59	240.5	47.6	14.	14.
1 to 6	9 32	16 48	340.3	56.7	16.8	14.
1 to 7	8 09	12 19	466.3	66.2	19.7	14.
1 to 8	7 09	9 27	605.8	75.7	22.6	14.
1 to 9	6 27	7 31	763.8	84.5	25.5	14.
1 to 10	5 44	6 07	950.6	94.	28.4	14.
1 to 11	5 13	5 02	1127.	103.5	30.7	14.

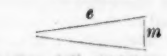
The above table is calculated from the following formula:

$$D = \frac{g}{\text{Sine of } \frac{1}{2} F} \qquad \frac{1}{2} F = \frac{\frac{1}{2} m}{l} \qquad D = \frac{g \times l}{\frac{1}{2} m}$$

in which D = distance from heel of switch to point of frog,
g = gauge of track,
F = frog angle,
l = length of the tongue of the frog,
m = distance across the mouth of frog tongue.

And for switch rail, $S = \sqrt{R - (R - t)^2}$, in which S = length of switch rail, R = radius of curve, and "t" the throw or movement of rail.

EXAMPLE.



Given, gauge "g" = 4 ft. 8½ in., "l" = 10, m = 1.

$$D = \frac{4 \text{ ft. } 8\frac{1}{2} \text{ in.} \times 10}{.5} = 94.16 \text{ ft.}$$

Also, given radius of curve 950.6 ft. and "t" = 5 in. Switch rail = $S = \sqrt{950.6 - (950.6 - 5 \text{ in.})^2} = 28.4$ ft.

In this method, the curve begins at the heel of the switch, the switch rail being a portion of the curve, made so by placing a stop at the center of the rail in a heavy fixed tie, so that when the rail is thrown, it is curved by bending around the stop. Railroad spike will answer for a stop, if the tie be well secured.

Preserving Government Land Marks—County and Other Land Surveyors.

Prof. C. D. Lawton, of the University of Michigan, has contributed to the Detroit *Tribune* the following discussion of a subject which is important in the States where the land was originally plotted and sold according to United States surveys. We are indebted to Mr. Lawton for corrections in the article:

Truly, as the wise man hath said, "there is nothing new under the sun." For away back among the earliest records of by-gone centuries, we learn that God's chosen people found it necessary to enact, "Thou shalt not remove thy neighbor's landmark!" and here I find in the morning paper the announcement that our Solomons (?) at Lansing, are even now discussing this very subject of how to preserve from removal the land marks of the farmers of Michigan.

However, if not a real, there is perhaps, an apparent difference between the ancient edict and the objects of the present legislation, in so far as the one was directed against the incroachments of man, and the other has immediate reference to the destroying effects of time.

But, to be serious, there has been a great deal of legislating in this State in regard to this matter of land surveys, extending over the entire period since the organization of the State Government. And really what does it all amount to? what particle of good has resulted from it? unless it be to demonstrate its entire inefficiency.

The land marks are rapidly disappearing. In the central portions of the State they have already, in many instances, become almost entirely obliterated. The marked trees have been cut away. The stakes have rotted and are gone, and everywhere the people are astonishingly careless in regard to replacing them, and neglectful of every means of restoring them. As we go back into the wilderness, the old lines may be retraced, and the government corners definitely ascertained; but as with "Lo, the poor Indian," with the advance of civilization, these boundaries rapidly disappear. By and by we shall reap the results of this recklessness, in a future of endless litigation.

We are simply laying up food for the legal profession, for it is well known that among the most fruitful sources of litigation, in the older States of the Union, are the disputes which arise over boundary lines of land. Fortunately, however, for us, cases of this kind have to a very limited extent, as yet, intruded themselves into our courts, for the obvious reason that the beautiful and complete system by which our States, in common with all the newer State and Territories, was originally surveyed and conveyed by the United States Government, rendered it easy for the settlers to determine their boundaries, which, united with the cheapness of the land, have prevented the occasion of such disputes.

It is certainly desirable that the old corners and landmarks should be preserved; that there should be uniformity in surveys; that they should be accurately made, the corners correctly established, and the bearings and lengths of boundary lines be precisely indicated, and the whole properly recorded, so as to furnish a reliable and comprehensive record accessible to everyone. But how is all this to be accomplished, is the question? Certainly not by the application of the enactments now upon the statute books. They have failed and are sure to continue to fail in giving us any satisfactory results. Is it not the part of wisdom, therefore, to sweep them all off the statute books, to leave this patching-up process, and radically seek out a better plan? Fortunately, we can accomplish this very simply. By an act of Congress passed as long ago as 1805, it was wisely declared that all corners, boundaries, and lines duly established by the United States Deputy Surveyors should forever remain fixed and immutable; whether originally correctly established or not, they cannot be changed. And all subsequent surveys must be governed thereby. Certainly, when we reflect upon the vast amount of land now and prospectively conveyed in accordance with the surveys, it will readily appear that this was one of the wisest laws ever enacted by our government. Now, our State having been originally surveyed and conveyed by the United States, we may avoid all difficulty by confining ourselves strictly to the requirements of the original law, and by adopting the same rules and regulations which have been adopted by the General Government for the instruction and guidance of all Deputy United States Surveyors engaged in retracing old lines, or in establishing boundaries or corners that have become obliterated; and in the subdivisions of sections. These methods, which govern in their practice, are suggested by the nature of the system of our government surveys, and by the long experience of the best surveyors, and cover every possible case that may arise in practice, and are invariably adhered to in the decisions of the courts.

The only way that the "Government corners" can be permanently preserved, is by causing a suitable stone monument to be placed at each of them.

I am convinced, however, that it is idle to depend on the land owners to do this. People do not preserve their corners. They will allow the stakes which mark them to rot away and disappear, under their very eyes, without ever renewing them. And this is *everywhere* the rule and *not the exception*. I have known men in New York to be satisfied with the results recently made of the survey of a division line; but to simply place some temporary marks to indicate it, which were afterwards carelessly allowed to disappear, without ever being renewed by anything more substantial, and then to commence disputing about the proper place for the line, and ultimately to expend hundreds of dollars in years of litigation over the matter. If they were the only ones to suffer, it might be well enough to leave them alone in their folly; but it so happens that a section corner or a government quarter post is a thing in which *all* the landholders on that and on the adjoining sections are equally interested, as will be all future generations of men who shall hereafter occupy the lands.

The necessity for *certainty* and *uniformity* would seem to indicate that the wisest course will be to provide for the establishment of permanent monuments at all the "government corners" within each township, at the expense of the whole township. This might be very readily accomplished with, in most instances, very little expense—certainly with little expense comparative to the good results necessarily resulting from the successful accomplishment of this enterprise.

Monuments thus permanently placed at these points, which are already, by act of Congress, the necessary points of reference, will remain for all future time standards for the peaceable adjustment of all boundary lines.

Now, a word in regard to surveyors. I notice the introduction of a bill to "protect people against quacks." Is it not possible that the public suffers from the operations of another class of quacks fully as dangerous to its interests as those of the medical profession. We allow persons to determine the boundaries of our land, and our highways, and of our water powers, without, perhaps, having any assurance of their ability to arrive at correct results. Any one is allowed to assume himself competent to take charge of such interests. But to administer to our ails, real or imaginary, to manage our affairs in court, persons must be possessed with a proper certificate giving them authority to act.

Why should not some similar provision be made in the former case to require land surveyors to possess themselves of an equivalent evidence of competency?

But *first* and primarily, the most *important* part of this whole matter is to provide for the *permanent preservation* of the "government corners."

Secondly. Adopt the same rules and regulation in regard to surveys that are established by the United States General Land Office.

Thirdly. We do not need county surveyors any more than we need county doctors; we want simply, competent, skillful men who are readily accessible. Do away with the office of County Surveyor, but require all surveyors to furnish evidence of competency, by passing an examining board, established for the purpose, the certificate of which shall give the surveyor authority to make surveys when called upon, to swear chairmen, etc., and furnish certified copies of the results for record.

Fourthly. Provide the County Register's office with blank books, one for each township in the county or considerable village, in which all certified surveys shall be lawfully recorded and indexed. Also provide at the county seat a permanent meridian line, and that the magnetic declination from this line be duly noted and recorded in a suitable book kept in the same office, and that annual or semi-annual observations be taken, with equal care, and duly recorded in the same manner. And, also, that each surveyor in the county be required to test his compass by this line, and to keep a record of the declination of his needle from it, which declination can be recorded with the record of each of his surveys. Also, that there be provided at the county seat a standard of linear measurement, and that each qualified surveyor be required (or allowed) to establish a similar line for himself for his more convenient and frequent reference, and that he be required to keep his chain exactly in conformity thereto.

We should thus approach more nearly to a uniformity in the bearings and measurements taken by different surveyors of the same lines.

The magnetic needle has ever been, in this country, and will doubtless continue to be very generally used in determining the direction of lines in ordinary land surveys. And it is well known that a large proportion of the disputes over boundaries, involve, simply, a question of their magnetic bearing. It is important, therefore, that each county possess a standard to which all surveyors shall be obliged to strictly conform.

Fifthly. Do not attempt to fix the matter of compensation. That should certainly be left to regulate itself. As in the practice of all other professions, let the fees in surveying depend on the skill and competition of those who follow it.

I have thus briefly outlined what, it seems to me, if properly elaborated and carried out in detail, will effect what we have for many years been trying to accomplish by legislation in this matter of surveying.

It is certainly a subject of much importance, concerning not only the present generation, but presenting a perspective of indefinite extent.

—A Richmond woman, correspondent of a Virginia paper, says she interviewed Gov. Walker the other day to ascertain his position on a railroad question, and that he asked, before committing himself, what her own predilections were; and when she said that she was on the fence, he graciously said: "Then, madam, I wish "no more agreeable position than to be sitting by your "side."

The Action of Steam in the Cylinders of Locomotives.

BY FRED. J. SLADE.

[Continued from Page 582.]

Release.—It would appear at first thought that a knowledge of the laws which govern the flow of gases, and steam in particular, would be all that was necessary in order so to proportion the areas of port opening, exhaust pipe, and blast orifice, as to obtain any precise amount of pressure (above that of the atmosphere) in the cylinder during the time of exhaust and the return stroke. A moment's reflection, however, on what has been discussed in the preceding paragraphs, in reference to the re-evaporation of water during this period, as well as the probability that a certain portion of the water contained in the cylinder will be discharged in the form of spray with the escaping steam, shows us that it is impossible to know exactly the weight of vapor that is to be discharged, and hence one element essential for the calculation by theory of the pressure which should exist in the cylinder is necessarily uncertain. And when we add to this the influence of friction in the passages and pipes, the liability of leakage of steam into the cylinder at the valve, and the influence of the exhaust of one cylinder on that of its neighbor, which depend upon circumstances peculiar to each case, and therefore do not admit of calculation, we see that we must trust rather to experiment and the evidence of the indicator than to any theoretical calculation of the back pressure.

The determination of what the back pressure should be according to theory, is, however, very useful, as affording a basis of comparison for engines having different forms and dimensions of exhaust passages, or working under different conditions. Thus, if in any case we calculate the amount of steam which theoretically should be discharged in a given interval of time, and compare this with the amount which appears from the indicator diagram to have been actually discharged in that time, we obtain a certain co-efficient of discharge, whose magnitude will depend upon the peculiar circumstances alluded to, and we shall thus be instructed as to what conditions are most favorable for a free escape of the steam, and a consequent low back pressure against the piston. The method in which this comparison of actual and theoretical discharge is to be made may be illustrated as follows:

Let C = the contents of the space from the piston to the end of the cylinder in cubic feet.

Cx = the contents of the space from the piston to the end of the cylinder in cubic feet, after the former has moved through a distance, x.

P = the pressure above a vacuum of the steam in the space, C.

Px = the pressure above a vacuum of the steam in the space, Cx.

Then $\frac{C\,P - Cx\,Px}{\frac{1}{2}(P+Px)}$ = the *apparent* actual discharge of steam in cubic feet at the mean pressure of $\frac{1}{2}(P+Px)$ .... (1)

Let A = the smallest area of opening occurring in the exhaust passage.

tx = the time in seconds occupied by the piston in reducing the contents of the cylinder from C to Cx.

Then taking from a table of the rates of flow of steam the velocity at which the steam should be discharged theoretically, when under the pressure $\frac{1}{2}(P+Px)$, and calling this V, we should have for the total quantity which ought to be discharged, were there no frictional resistance, and no other disturbing causes to influence the escape,

$$V \times tx \times A \quad .... \quad ... \quad (2)$$

The quantity (1) divided by the quantity (2) gives the relation between the apparent actual discharge and the theoretical, or we may say between the actual least area, A, and the effective area under all modifying circumstances, and this ratio we will designate, for convenience, R.

To illustrate this by a few examples:

The back pressure shown on the diagram in Fig. 11 (see next page), taken from engine No. 204, Erie Railway, when running at 160 revolutions, gives on analysis the following series of values for R:

Inches of stroke.	Area of smallest opening in sq. inches.....	Time in seconds (tx).....	Average pressure in pounds above the atmosphere.....	Apparent actual discharge in cubic feet.....	R.
17⅞—19¼	4.14	.093	22	.51	.35
19¼—20	8.3	.019	12	.731	.51
20 —18	8.3	.043	6	1.14	.40
18 —16	8.3	.019	4	.338	.37
16 —14	8.3	.015	3 8	.332	.45
14 —12	8.3	.013	3.5	.269	43
12 —10	8.3	.0124	3.5	.312	.52
10 — 8	7.6	.0124	3 5	.294	.54
8 — 6	4.8	.013	3.8	.302	.52
6 — 5	1.7	.007	6.5	.025	35
				Average	.444

The inches of the stroke are for convenience designated as they would be counted on the steam stroke, instead of counting from the commencement of the return stroke. The steam ports were 15½ in. by 1¾ in., and the diameter of the exhaust nozzle was in this case 3¼ in., a separate pipe and opening being provided for each cylinder, and this was for the greater portion of the stroke the smallest opening through which the steam had to pass, and as the rest of the exhaust passage is considerably larger than the blast nozzle, we should expect a high coefficient for the effective area of this opening. We find, however, that the average value is only .444. That is to say, less than half as much steam appears to have been discharged through the smallest exhaust opening as was due to the theoretical velocity of steam passing unretarded through such an aperture. It will be observed that the efficiency of the opening increases toward the end of the stroke, which may be best accounted for by the assumption that the evaporation and discharge of water from the cylinder during the first part of the exhaust reduces the apparent discharge at that time, though in reality as great a quantity of steam proportionately to the area of opening and pressure may be discharged at that time as at the latter portion of the stroke; and this illustrates why it is proper to call the discharge measured in this way the *apparent* discharge.

A diagram from engine No. 203, Erie Railway, gives the results recorded in the table at the head of the next column. This engine had steam ports 15½ in. by 1⅜ in., and a pair of exhaust nozzles 2⅞ in. diameter. The card was taken when the engine was running at 144 revolutions, and developing the unusual amount of 519 horse power; the back pressure is accordingly very large, though the relative efficiency of the opening remaing almost exactly the same as in the previous example.

Inches of stroke.	Area of smallest opening in sq. inches.....	Time in seconds (tx).....	Average pressure in pounds above the atmosphere.	Apparent actual discharge in cubic feet.....	R.
17.85—19.4	3.94	.025	35	.63	.564
19.4 —20	6.49	.0255	23	.57	.32
20 —18	6.49	.048	15	1.17	.38
18 —16	6.49	.0206	10.5	.495	.415
16 —14	6.49	.0165	9	.456	.50
14 —12	6.49	.0143	7.9	.353	.46
12 —10	6.49	.0136	7	.324	.46
10 — 8	6.49	.0136	6.9	.333	.475
8 — 6	4.75	.0143	6.8	.294	.56
				Average	.46

A third diagram taken from No. 204, when starting from a station, the steam being admitted during 9-10 of the stroke, and consequently having a very high pressure at the commencement of the exhaust, gives the following results:

Inches of stroke.	Area of smallest opening of sq. inches.....	Time in seconds (tx).....	Average pressure in pounds above the atmosphere.	Apparent actual discharge in cubic feet.....	R.
20—18	8.3	.0783	35	2.56	.346
18—16	8.3	.0339	13	1.06	.415
16—14	8.3	.0273	7	.72	.43
14—12	8.3	.0235	4.9	.516	.44
12—10	8.3	.0225	1.75	.500	.59
10— 8	8.3	.0225	.35	.389	.88
				Average	.517

The ratio in this case appears slightly larger than in the preceding example from the same engine, but this may be due merely to the fact that as the back pressure line approached very near to, and ultimately sensibly coincided with the atmospheric line, the determination by measurement of the exact difference of pressure between the two was more difficult, and the last value of R may be somewhat too high. In general, it will be observed that the smallest opening through which the steam has to pass is the exhaust nozzle, and as the remainder of the passage is of considerably larger area, and of short length, the circumstances in a locomotive are favorable to a high value of R.

Performing the same calculation with diagrams from other types of engine, where the exhaust pipe is longer and of more uniform diameter throughout, we find that the value of R is considerably less. Thus an engine of 10 in. cylinder by 20 in. stroke, whose least exhaust opening was at the valve, viz., 2.89 square inches, the exhaust pipe being 2½ in. diameter, or 4.9 square inches area, 21 ft. long, and having four elbows in its course to the condenser, gives a value for R of 16, the exhaust commencing at about the atmospheric pressure, and that existing in the condenser being 8½ lbs. below that point. Judging from a number of diagrams that the writer has calculated in this way from stationary engines of various ordinary types, it would appear that .25 is a fair average value for R, under the circumstances usually existing in regard to the exhaust of such engines, though if the exhaust pipe be straight and considerably larger than the valve opening, a value for R will be obtained more nearly like that found above for a locomotive.

The value of R varies, however, with the speed of the engine, being greater as the discharge is more rapid. Taking the results of a number of diagrams at different speeds, we have the following quantities:

AREA OF EXHAUST OPENING 8.3 SQUARE INCHES.

Revolutions per minute.	Values of R.
240	.7
188	.6
187	.5
160	.51—.5—.46
112	.37

AREA OF EXHAUST OPENING 6.5 SQUARE INCHES.

Revolutions per minute.	Values of R.
210	.66
198	.58
168	.48
122	.40
120	.49

AREA OF EXHAUST OPENING 5.94 SQUARE INCHES.

Revolutions per minute.	Values of R.
190	.66
135	.48
125	.45
110	.42
84	.41
75	.39

The explanation of this increase in the apparent efficiency of the exhaust opening at high speeds is no doubt to be found in the fact already dwelt upon, that less time for condensation and re-evaporation is afforded when the piston is working with great velocity, and therefore the steam is comparatively dry when discharged, and the actual weight delivered approaches more nearly to that due to the capacity of the cylinder. For the different areas of exhaust opening the valves are substantially the same.

These figures are of value, as they enable us to determine, with tolerable accuracy, what will be the amount of back pressure during the return stroke of a locomotive at any given speed, the dimensions of the blast orifice being known. To do this we have simply to ascertain what would be the velocity of discharge of the steam through the aperture due to the motion of the piston alone; divide this by the proper value of R, as indicated by the foregoing tables, and find by ordinary rules the pressure required to produce the velocity given by this quotient.

The average back pressure taken through the whole stroke, however, is largely influenced by the amount of steam in the cylinder to be discharged at the opening of the exhaust. Where this is considerable the back pressure does not fall to its normal amount till late in the return stroke, while if there is but a small amount to be discharged, the back pressure line on the diagram will be nearly at a constant height above the atmospheric line during the greater part of the stroke. The influence of the high pressure of steam at the end of the stroke is shown by the following curves, which have been plotted from an analysis of diagrams taken from the engines of the Erie Railway. The first series, fig. 7, show the variation of average back

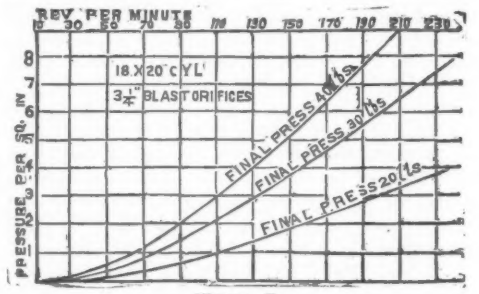


Figure 7.

pressure with the same area of blast orifice, due merely to the difference of final pressure; the second series, fig. 8, show the pressure with orifices of

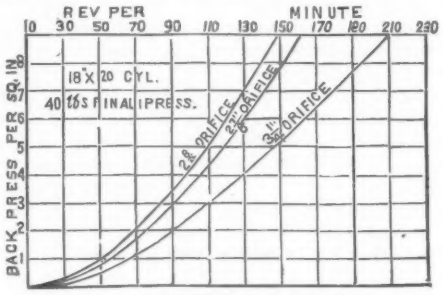


Figure 8.

different dimensions, at a constant final pressure of 40 lbs. The cylinders in all cases were 18 in. in diameter, the stroke in all cases but one 20 in. In the case of the engine with a blast orifice of 2¾ in. diameter, the stroke was 22 in., but in order to compare it properly with the others, the actual number of revolutions has been increased 1-10 in tabulating the results, as the velocity of discharge of the steam would be greater than in the engines of 20 in. stroke in just that proportion. The final pressure is measured at 9-10 of the steam stroke, at which point in all cases the exhaust had commenced. The average back pressure represented by the curves is estimated from the commencement of the return stroke to the closing of the exhaust and the beginning of compression.

The nature of the pipe and orifice used for discharging the steam makes a material difference in the amount of back pressure in the cylinder. Thus, if the exhaust pipe be formed with sharp angles, the steam will be seriously retarded in its escape, and necessitate a greater pressure in the cylinder to effect its discharge. But the most striking effect on the back pressure is produced when both cylinders discharge their steam through the same nozzle. In these cases the bulk of steam issuing from one cylinder at the opening of the exhaust causes a considerable rise of back pressure in the other at the middle of its stroke, which, if the engine is working with a heavy pressure of steam and at a slow speed, will show a sudden rise in the back pressure line of many pounds, and a subsequent fall to about its original level; but if the engine be working at a high speed the increase of back pressure will remain during nearly the whole stroke, though it will be less in amount. Figs. 9 and 10, from an engine of 18 in. × 20 in. cylinder, with a 3½ in. exhaust nozzle common to both cylinders, show the effect referred to. In the case where the steam is admitted during nearly

the whole stroke, the back pressure rises to 17½ lbs., in the other case to 7 lbs., and falls again to 2¼ lbs. near the end of the stroke. The shape of the exhaust pipes was such as to give the steam a motion in the direction of the orifice before the two united, so that the steam from one pipe should not be discharged directly into

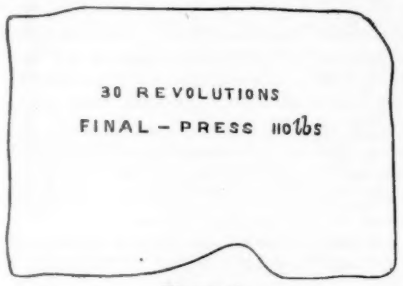
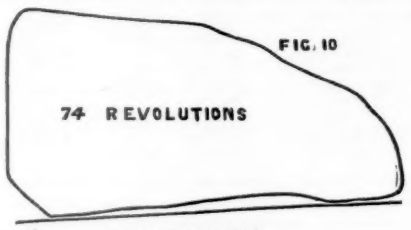
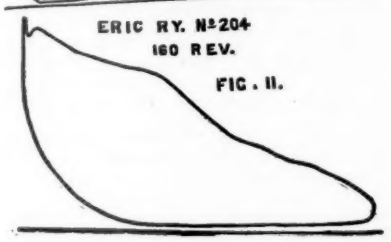


Figure 9.

the other, nevertheless the rise shown took place, showing clearly the advantage of a separate nozzle for each cylinder.

The back pressure will also be greatly increased by the presence of water in the cylinder, as if the weight





of the steam be augmented by the presence of spray, it is evident that its velocity of flow must be correspondingly diminished, or in other words, to produce a given velocity will require a greater pressure. Practically this is of great importance, as it is well known that the presence of water in the cylinders will diminish materially the power of an engine, besides, as we have already seen in a former portion of our subject, giving rise to a loss of steam from condensation in the cylinder.

To provide a free release for the steam after its work in the cylinder has been performed, is perhaps the most important duty of a valve motion, and to secure this it is necessary that *the valve should commence to open well before the piston reaches the end of its stroke.* If the steam be confined till the last instant, it will not be fully discharged till the very end of the return stroke, and it is easy in this way to lose even as much as a quarter of the effective pressure. On the whole, the link motion is well suited to afford a good release, from the valuable feature that when cutting off short, as is always the case at high speeds, the exhaust commences when the piston has performed but about 85 per cent. of its stroke. The loss of power from premature escape of the steam is but trifling, while the freedom from back pressure secured is of the highest importance.—*Engineering.*

[To be continued.]

Ventilation.

The following extracts are reprinted from the second annual report of the State Board of Health of Massachusetts. They are a forcible statement of the importance of thorough ventilation, and the principles advocated are as applicable to cars as to school-houses. We wish every school director, teacher, railroad superintendent, master car builder, and conductor could read what the report says on

THE VENTILATION OF SCHOOL HOUSES.

The importance of thoroughly ventilating school houses is acknowledged by every body, while the number of persons who have considered the amount of ventilation required to keep a room in a wholesome condition, and the best way to produce the necessary change of air is comparatively small.

All know that the condition of the air in most school rooms an hour after the session has commenced is very bad, so bad as to induce a morbid condition of the system, impairing the mental vigor of both teachers and scholars.

The cause of the trouble is commonly stated to be the presence of carbonic acid in the air which we exhale. When first thrown off from the lungs it is warmer than the surrounding air, and therefore rises to the upper part of the room; consequently, in the popular idea, the bad air is always at the top of the room. According to the same theory it is only necessary to make a hole somewhere in or near the ceiling to let it off, and thus the room is properly ventilated. This theory of ventilation, it should be noticed, makes no provision whatever for a supply of fresh air in those school rooms (no small proportion of the whole number) which are warmed by stoves. In cases where furnaces are used, they are commonly regarded as sources merely of heat, seldom as the means of a supply of *fresh air*. Registers are placed somewhere in the floor but their size and disposition are left to convenience or to the discretion of the furnace dealer, whose sole aim is to furnish *heat*, not air. True, some air must make its way through the hot-air pipes, but as soon as the temperature of the room is so high as to be too warm for comfort, the register is closed, thus shutting off entirely any supply of fresh air except what may creep in through the crevices around the doors and windows. If further relief from heat or close air becomes necessary, the windows are let down a little from the top. The result of this is that cold air rushes in and fills the bottom of the room causing dangerous draughts for those who sit near the windows, and cold feet for everybody.

If we examine this popular notion concerning the theory and practice of ventilation, we shall find its explanation of the cause of the difficulty falls as far short of stating the whole case as the remedy proposed fails to accomplish the desired end.

As we have seen, the carbonic acid gas exhaled from the lungs is looked upon as the principal evil. Its presence is, indeed, clearly recognized, and the amount given off by the lungs has been determined to be about four per cent. of the air exhaled.*

But so far from its being the principal evil in vitiated air, it is proved by experiment that a still larger proportion of carbonic acid than is contained in the close air of an unventilated room may be mixed mechanically with ordinary air, and breathed without inconvenience. The workmen engaged in the manufacture of soda-water do not experience any ill effects from breathing large quantities of it.

We must, then, seek further for sufficient causes for the foul condition of the air in an occupied room. We shall discover in it not only this deleterious acid, but in still greater proportion the watery vapor and the animal matter thrown off by both lungs and skin. The amount of watery vapor given off by the lungs and skin has been variously estimated at from twenty to forty ounces in the twenty-four hours, or about six to twelve grains (troy) per minute. This vapor contains animal matter which seems to putrefy almost immediately after being thrown into the air. It is the source of the vile odor in an ill-ventilated room, and, in its effects on the health, is far more dangerous than carbonic acid gas, which is now generally considered as acting rather as an obstruction of respiration than as a positive poison. No surer or more exact test than a well-educated nose has, as yet, been discovered to measure the amount of vitiating animal matter thus thrown into the air, but of its sources we can form some inferences.

The immediate emanations of the body itself we have just mentioned. All clothing, carpets, and furniture are adding constantly to the air the minute particles worn off by friction. A beam of sunlight thrown across the best kept room marks its way on the dust in the air, and we all remember what we have seen floating in the air of school-rooms. Still another element of evil must be counted in the clothing of children of the poorer classes, which is worn and kept in homes that have never known an airing. It is easy to detect, in some school-rooms, the odors resulting from the different occupations of the children's parents, mingled with the scent from the frying of the family dough-nuts or the smoke of the paternal tobacco pipe. What science hints of the germ of disease in the air about us might startle the most careless; but such details are unnecessary when we are discussing ventilation, not for cases where great crowds of people are assembled, or where unusual causes create foul air, as in the sick wards of a hospital, but in relation to the far simpler question, How we can best ventilate and warm our school-rooms.

One general consideration remains to be added to this brief statement of the elements of evil in foul air. The air we breathe is exhausted of its life-giving power after a few inhalations. Deprived of its normal proportion of oxygen, it is thus rendered unfit for its proper uses. Again, the carbonic acid, the watery vapor, the animal matter and the minute dust are soon diffused throughout the room. The question where the air is worst may be taken up later, but it must be manifest, from what has been said, that the entire air of a close room soon becomes vitiated in every part. Still further, we are considering rooms in which the children daily spend five or six hours: the teachers often seven or eight. The children are at an age when respiration is most active, and when nature demands an ample supply of air of the purest quality.

We are, then, forced to conclude, from the nature of the evil, and from the imperative necessity of its entire removal, that no remedy can be successful which does not insure a full and complete renewal of the air in the room as often as it becomes foul or dead. Nothing less than an absolute change of the whole volume of air can accomplish the object.

How often this should be done within a given time must depend upon the size of the room and the number and age of the persons occupying it. Authorities differ as to the amount of air to be supplied to insure a proper ventilation, but it is generally admitted that it should be not less than ten cubic feet per minute for each person. It may be that children require as much as adults, as they breathe faster. The actual amount of air space in the room must also be carefully considered.

The Royal Commissioners appointed by the British Government to inquire into the sanitary condition of the barracks and hospitals, reported in 1857, that the rooms should be not less than six hundred (600) cubic feet of air-space for each soldier, and the supply of air per minute and per man not less than twenty cubic feet. Messrs. Fairbairn, Glaisher and Wheatstone reported about the same time to the general bureau of health that the supply should be from fifteen to twenty cubic feet per minute for each individual. General Morin, the Director of the *Conservatoire des Arts et Metiers*, gives the amount at from twenty to thirty cubic feet. These estimates, it will be observed, are for adults, and, in the case of the soldiers, for sleeping-rooms occupied from eight to nine hours consecutively.

* The difference in quantity is caused by varying circumstances. The amount thrown off is least during the night and greatest during the day. It would seem that the maximum and minimum amounts depend upon the State of digestion or the degree of physical exertion.

AIR, AND SOME OF ITS IMPURITIES.

No one can study the causes of disease without being convinced of the infinite importance of pure air to the preservation of health. This general truth meets us at every turn. Sometimes, as in the case of air spoiled by respiration, the reason is obvious enough to every one who understands the changes which take place in breathing; certainly, in so far as the interchange of oxygen and carbonic acid is concerned.

In other cases, as when air seems to be the vehicle for the transfer of the hidden poison of the zymotic diseases, it is, as yet, obscure. We do not propose at present to enter on this dangerous (because, as yet, partly hypothetical) ground. Allusion to it will be found in many pages of the present volume. Indeed, in any study of the causes of disease, at the present day, it is impossible to ignore it, however anxious we may be to keep within the strict bounds of scientific truth. In some way, as yet but imperfectly understood, the organic matter in air seems either to be or to contain the agent by which certain changes are impressed upon the blood in the lungs, which changes become the proximate cause of the phenomena of typhoid fever, and scarlet fever, and measles, and many other of our most destructive maladies. Whether this organic matter be waste tissue which once had life, and has now undergone some metamorphosis incident to decay, or whether it be living organism, seed, germ, spore or vital radicle of any sort, no one yet knows, or perhaps we should say that no one who thinks he knows can yet prove his knowledge. The search for this foe to our health, for this hidden something which works with such fatal power, is keen. The chemists, the microscopists, the natural philosophers, are all aiding in the study of its origin, its character, and the means of separating it from the air, which all believe conveys it. It has even become, through the popular teachings of Professors Tyndall and Huxley, a subject of rather general discussion, during the past year. It should, however, never be forgotten that it is to the unobtrusive labors of men devoted to science, like Dr. R. Angus Smith, of England—labors pursued unremittingly for a quarter of a century, and modestly published in scientic reports that we know all, or nearly all, which is available in speculations on this obscure subject. The eloquent men who have recently interpreted the facts of Angus Smith and Pasteur, and Beale, and Hallier, and Sanderson to the general public in a way to arrest the attention of the busy world have in this respect done good service, but they have added almost nothing to the stock of existing knowledge.

We would gladly contribute our proportion of exact observation, however small it may be, to this great subject, so full of interest and promise.

During the present year careful note has been made of the proportion of carbonic acid contained in the air of inclosed places of various sorts, and also of the outer air at different seasons of the year. We hope to continue this line of research in future years, and, by the aid of chemists and microscopists, to determine the amount of organic matter which the air may hold under various circumstances, and to learn, if possible, something of its nature.

Although carbonic acid is not now generally regarded as a poisonous gas, but rather as an obstructor of respiration, and, therefore, impeding all vital processes, its amount in crowded and ill-ventilated rooms is a tolerably correct measure of the degree of impurity there present, and is specially worthy of observation as an index of the proportion of dangerous material coming from the waste of the body, with which, under such circumstances, it is always associated.

The amount of carbonic acid found in the fresh outer air will furnish a standard of the quality of the normal air of Massachusetts, and may also lead to a better knowledge of some of the peculiarities of the climate of our State in comparison with that of other countries.

In illustration of the value of the determination of very small amounts of impurity in air, we quote the following remarks of Dr. R. Angus Smith, from a paper on "Chemical Climatology," in the *Scottish Meteorological Journal*, January, 1870:

"Some people will probably inquire why we should give so much attention to such minute quantities—between 20.980 and 20.999 of oxygen—thinking these small differences can no way affect us. A little more or less oxygen might not affect us, but supposing its place occupied by hurtful matter, we must not look on the amount as too small. Subtracting 0.980 from 0.999, we have a difference of 190 in a million. In a gallon of water there are 70,000 grains; let us put into it an impurity at the rate of 190 in a million; it amounts to 13.3 grains in a gallon. This amount would be considered enormous if it consisted of putrefying matter, or any organic matter usually found in waters; but we drink only a comparatively small quantity of water, and the whole thirteen grains would not be swallowed in a day, whereas we take into our lungs from one thousand to two thousand gallons of air daily. The detection of impurities in air is therefore of the utmost importance; and it is only by the finest methods that they can be ascertained in small quantities of air, even when present in such quantity as to prove deleterious to health.

* * * * * * * * * * * * *

"If, by inhalation, we took up at the rate of thirteen grains of unwholesome matter per day—half a grain per hour—we need not be surprised if it hurt us. Such an amount is an enormous dose of some poisons, and yet this is not above one two-thousandth part of a grain at

every inhalation. It is marvelous what small amounts may affect us, even when by repeated action they do not cumulate as certain poisons do. The carbonic acid numbers might have been used for this illustration instead of the oxygen numbers, with the same result."

On the Proper Resistance of Telegraphic Relays.

The following article, which appeared lately in the *Scientific American*, was prepared, we are informed, by David Brooks, the eminent electrician. It gives information of great value to all electricians on a subject hitherto not very definitely settled.

There is not, as a general thing, any well-defined idea, among telegraph men, of the amount of resistance which develops the greatest attractive force, or magnetic effect, in a relay. If there be no resistance, there is no effect, and, on the other hand, when the resistance is infinite the effect is also nothing. The practical question, therefore, is to determine the amount of resistance that produces the maximum effect.

In order to make this point clear, it is necessary to state that every turn or convolution of a conducting wire around the core of an electro-magnet, produces in the latter a certain magnetic effect. Two turns produce twice the effect of one turn, but the length, and consequently the resistance, of the wire is also doubled.

Now, as the magnetic effect is always inversely in proportion to the resistance of the circuit, this effect would remain unaltered—that is, it would be the same with two turns as with one turn, were there no other resistances in the circuit. But there are other resistances in the circuit; namely, that of the battery, and the connecting wires, and the sum of all the resistances must be doubled, in order to halve the attractive force of the magnet. Therefore by multiplying the turns of wire in the helices, the magnetic force is augmented.

If we wind one layer of convolutions of silk-covered wire in a helix of given size, we get a given number of turns, and it is evident, with a smaller sized wire we can get a greater number of turns, but, on the other hand, the smaller wire has a greater resistance, and this again diminishes the magnetic effect.

To illustrate this: I have taken a spool of the dimensions of an ordinary telegraphic relay. The spool is two inches in length, and the inside diameter one-half inch. It is wound with silk-covered wire to the depth of one-half inch. The spool then has a diameter of one and a half inches, by two inches in length, outside measurement. Of course, one half inch of the diameter is the iron core in the center.

The spool was first wound with No. 20 wire (Birmingham gauge), the turns or convolutions carefully counted, and the resistance measured. Both the resistance and the number of convolutions in a relay will be double that of a single spool. Therefore, by winding this spool successively with the different sizes of wire, from No. 20 up to No. 35 (Birmingham gauge), counting the number of convolutions, and measuring the resistance in Siemen's units, we have the following table of results:

Relays. Size of wire.	Number of convolutions.	Resistance. Siemen's units.	Relays. Size of Wire.	Number of convolutions.	Resistance. Siemen's units.
No. 20	1,616	4.2	No. 28	6,536	87.0
" 21	1,904	5.92	" 29	8,016	135.5
" 22	2,256	8.32	" 30	9,496	184.2
" 23	2,816	16.6	" 31	10,784	280.1
" 24	3,376	25.6	" 32	12,080	376.0
" 25	4,136	39.8	" 33	12,568	416.0
" 26	5,088	46.2	" 34	13,064	504.0
" 27	5,828	67.4	" 35	13,600	560.0

This table may be considered a fair approximation to the actual value of the resistance and magnetic effect produced in relays wound with silk-covered copper wire, from No. 20 to No. 35 (Birmingham gauge). In practice, we are required to select from these relays the one best adapted to the conditions of a given circuit, that is, the one which has the greatest attractive force. The latter is in direct proportion to the number of convolutions in its helices, and inversely in proportion to the total resistance in the circuit.

Suppose, for example, we have a wire 100 miles in length, of the usual average resistance, say 20 units per mile, and we wish to use one relay at each terminal without intermediates. Say there are 50 cells of battery giving 2 units resistance per cell. We can find by trial and calculation which relay will give the best result, and is therefore best adapted to the circuit:

	Units.
The line resistance is	2,000
The battery resistance is	100
For trial, we select the relay wound with No. 30 wire. The two relays will give twice 184.2 —	368
Total	2,468

These relays have 9,496 turns of wire each, which, divided by the total resistance to the circuit, gives a quotient of 3.84, and this represents the effective strength of the magnet wound with No. 30 wire.

We will now substitute the magnets wound with No. 35 wire, and observe the comparative effect:

	Units.
Resistance of line and battery (as before)	2,100
Resistance of 2 magnets (as per table)	1,120
Total resistance in circuit	3,220

Dividing the number of convolutions by the above resistance, we have $\frac{13,600}{3,220}$=4.22.

We find, therefore, that for a line of No. 9 iron wire, 100 miles in length, relays wound with No. 35 wire produce a much greater effect than relays wound with a coarser wire, and are better adapted to that circuit, when only two relays are used, one at each terminal.

By the same process we find that the relays become less and less adapted to the circuit, as the size of the wire in the helices is increased.

For another example, we will take a wire with many intermediate stations. Say the length of the line is 100 miles, and the number of relays in circuit twenty.

Calling the resistance of the line and battery 2,100 units, as before, add to this resistance 20 times that of any one of the relays in the above table, and dividing the number of convolutions by the total resistance, we find, by trying each magnet separately, that No. 28 wire, with 87 units resistance, gives the highest quotient, and is consequently the relay best adapted to that circuit.

Commencing with the No. 20 wire, and going through the list, we have, for quotients, or magnetic effects, the following:

No. 20	0.74	No. 28	1.70
No. 21	0.85	No. 29	1.67
No. 22	1.00	No. 30	1.64
No. 23	1.15	No. 31	1.40
No. 24	1.29	No. 32	1.24
No. 25	1.42	No. 33	1.15
No. 26	1.68	No. 34	1.06
No. 27	1.69	No. 35	1.00

We will now take the case of a short local telegraph of two miles of wire and four relays used as sounders, in which it is required to find what resistance in the sounders will produce the best results. Say the battery has ten cells of 2 units resistance each, and two miles of wire, at 20 units per mile. The total resistance of the battery and line will be 60 units. By trial, it will be found that the No. 22 wire sounder, having a resistance of 8.32 units, is the best instrument for such a circuit.

This investigation of the effect of winding a spool, or constructing a helix with different sizes of silk-covered copper wire, was carried no farther than to No. 35. It is evident that if the spool had been lengthened one inch, we would have obtained 50 per cent. more convolutions, and increased the resistance in the same ratio, giving us 20,400 convolutions and 840 units resistance for the relay.

On a line of 300 miles, with a relay at each terminal, the gain in magnetic effect, with this relay of 840 units resistance, is about 50 per cent. over the one wound with No. 32 wire, having a resistance of 376 units. On a line of 500 miles the gain is about 55 per cent. and on 1,000 miles 72 per cent., showing that the greater the resistance of the circuit, the greater the number of convolutions required in the relays, the resistance of which will necessarily be in exact proportion to this number.

Ruhmkorff's astatic galvanometer, an instrument made to detect currents in a circuit of great resistance, has itself a resistance of 7,000 units, and 40,000 convolutions of very fine wire.

We can see from what has been shown above how unsuited an ordinary relay is for a local sounder. We could probably get about 1,000 turns of No. 18 wire on these spools, and the resistance would not be over one unit. With one Grove cell for battery, we would have but two units resistance in circuit. Dividing the number of convolutions by the resistance, we get a quotient or magnetic effect of 500. If we wind the same spools with No. 32 wire, and divide the number of convolutions, 12,080, by the resistance, 377 units, the quotient is 32, or less than one-fifteenth the effect produced by the coarse wire.

By the aid of the above table of convolutions and resistances, and a Siemens' galvanometer, any one can determine, with a sufficient approximation to accuracy, the resistance of the relays best suited to the circuit, and work up his own particular case.

RULE.—Select from the column of resistances that of any particular magnet. Multiply this resistance by the number of magnets in the circuit To this product, add the resistance of the line and battery. Divide the number of convolutions, in the relay selected, by this sum. By this method, ascertain the relay giving the greatest quotient, which is the one best adapted to the circuit.

Railroad Earnings in February and from January 1 to March 1.

The reports of February traffic, obtained from the various railroad companies which make public their earnings, show various results and exhibit no uniform movement either on the side of increase or decrease, as compared with the same month of 1870. The roads, indeed, are so differently located, and liable to have their earnings affected by such different causes, that a general movement, either upward or downward is now seldom noticed in the duller months of the year, when there is no heavy transportation of cereals or other produce, and local traffic, together with the through business rendered necessary by the absolute demands of trade, constitute the whole business.

Among the old roads, Chicago & Alton, Marietta & Cincinnati, Michigan Central, Ohio & Mississippi, and Toledo, Wabash & Western, show a fair increase in earnings ranging from $23,266 to $113,538, as shown below; while on the other side, Illinois Central shows a decrease of $96,373, and Milwaukee & St. Paul $55,367. Central Pacific shows an increase of $86,909, and Union Pacific a decrease of $104,370 in gross earnings, though a decrease also in expenses and a consequent increase in net receipts of $87,285. It will be observed that the Marietta & Cincinnati and Ohio & Mississippi roads are among those which show an improvement in earnings, a fact which is worth noticing, since it is probably due in part to the completion of the bridge over the Ohio River at Parkersburg. The increase in the receipts of these roads should be still more marked after the change to narrow gauge has been effected in the Ohio & Mississippi, although the full benefit of that change will not be apparent in the reports of gross receipts, but should be felt also in a large decrease of expenses.

For the month of March earnings may be affected to some extent by the lower tariff on through freights which has just been adopted by the New York Central & Hudson River Railroad, the Erie and the Pennsylvania Central lines to the more important Western points, as follows:

FREIGHT LIST.

Per cwt. for first-class goods, including dry goods, boots and shoes, and general merchandise, from New York, West:

	New rate.	Former rate.
To Chicago, Ill	$1 00	$1 50
Cairo, Ill	1 39	1 92
Louisville, Ky	1 14	1 66
Nashville, Tenn	1 43	1 82
Memphis, Tenn	1 68	2 07
Cincinnati, Ohio	90	1 38
Cleveland, Ohio	66	98
Toledo, Ohio	78	1 15
Sandusky, Ohio	78	1 08
Detroit, Mich	71	1 06
Grand Rapids, Mich	1 21	1 50
Kalamazoo, Mich	1 18	1 50
Kansas City, Mo	1 84	2 44
St. Louis, Mo	1 29	1 89
St. Joseph, Mo	1 89	2 49
Keokuk, Iowa	1 34	1 94
Milwaukee, Wis	1 00	1 50

The rates by steamer, by way of Buffalo to Lake Michigan ports also show a considerable reduction in prices.

The earnings in February upon twelve of the principal roads were as follows:

RAILROAD EARNINGS IN FEBRUARY, 1871.

	1871.	1870.	Inc.	Dec.
Central Pacific	$481,085	$394,176	$86,909	....
Chicago & Alton	340,301	316,036	24,265	....
Cl'vl'd, Col., Cin. & Ind.	256,789	226,897	29,892	....
Illinois Central	565,415	661,788	....	$96,373
Marietta & Cincinnati	126,224	98,275	27,949	....
Michigan Central	442,665	329,127	113,538	....
Milwaukee & St. Paul	327,431	382,798	....	55,367
Ohio & Mississippi	258,554	218,234	40,320	....
Pacific of Missouri	217,547	267,867	....	49,920
St. Louis & Iron M'nt'n.	122,372	95,665	26,707	....
Toledo, Wabash & W'n	328,791	293,645	35,146	....
Union Pacific	305,769	500,139	....	194,370
Total	$3,783,343	$3,784,647	$394,726	$396,030

For the two months of the year which have now elapsed, earnings generally show much the same results as in February, the same roads showing balances on the side of decrease. There seems every prospect, however, that as the year goes on, the business done upon the old established lines will be equal to that of last year; upon the new roads, an increase, of course, is to be expected. Upon the basis of last year's traffic a paying business may be anticipated where roads are managed with economy. The steady progress of railroad traffic for several years past has been such as to give every encouragement to parties pecuniarily interested in this property, whenever ability is shown in the management; on the other hand, the desire on the part of officers to extend their lines by leasing or constructing new roads and branches has often been carried so far as to saddle upon good roads a large amount of heavy expenses, without any adequate remuneration.

EARNINGS FORM JAN. 1 TO MARCH 1.

	1871.	1870.	Inc.	Dec.
Central Pacific	$1,017,883	$807,280	$210,303	....
Chicago & Alton	683,856	597,144	86,712	....
Clevl'd, Col., Cin. & Ind.	536,937	429,966	106,971	....
Illinois Central	1,204,955	1,285,171	....	$80,216
Marietta & Cincinnati	257,107	188,452	68,655	....
Michigan Central	851,490	667,119	184,301	....
Milwaukee & St. Paul	734,131	778,970	....	54,839
Ohio & Mississippi	504,535	415,021	89,514	....
Pacific of Missouri	429,952	470,314	....	40,362
St. Louis & Iron Mountain.	248,590	187,846	60,744	....
Toledo, Wabash & West'n	693,945	551,308	142,657	....
Union Pacific	653,376	1,028,668	....	375,292
Total	$7,816,407	$7,407,259	$969,857	$550,709

—*Commercial and Financial Chronicle.*

Feed-Water Heater.

The Connecticut River Railroad is testing on their engine "Whately," a "feed heater," the result of six successive inventions by I. P. Magoon, of St. Johnsbury, Vt., an old engineer on the Passumpsic road and brother of Magoon who commands the Whately. Thus far it works well. The Whately has done good service but was getting a little lazy and apt to lose time; but, inspired by this invention, it is fully up to its work. A saving of fuel, however, is what is especially claimed for the "feed heater." The water is pumped from the tank in the tender through a copper pipe, 1½ inches in diameter, to the "heater," which is a coil of pipe of the same size around the "cone pipe" in the smoke stack, and from this coil the water, heated to more than 200 degrees Farenheit during its passage through the coil, passes in a copper pipe on the side of the boiler opposite its passage when cold, and into the boiler. The heat used in raising the water to this temperature is waste heat, escaping through the cone pipe. A portion of the "exhausted" steam passes through an extra "exhaust pipe" to the "heater," and helps in the heating process. The water thus entering the boiler well advanced toward the state of steam, less fuel is required to bring it to that condition, and the hot water in the boiler is never set back by cold floods from the tank.—*Springfield Republican.*

—A brakeman on an Ohio railroad who, while in the discharge of his duties on the top of a freight car, was caught under the chin by a telegraph wire that passed across the track, and thrown beneath the cars, sustaining thereby the loss of a leg, brought suit for damages against the telegraph company, and has recovered $9,000.

General Railroad News.

RAILROAD LAW.

Horse Railroad Companies—As to the General Public only Ordinary Care and Prudence Due from Railroad Employes—Damages from Excavations in Streets.

The late case of the *Pendleton Street Railroad Co. vs. Shires et al* was founded upon the following chief facts: An excavation had been dug across a street over which the track of the railroad lay. To pass this ditch the company caused the horses attached to a certain car to be unhitched and driven round the excavation. In so doing a team of horses ran away from the driver, and, in running, knocked down and quite seriously injured a woman who was passing along the street, and who brings suit. Among the instructions given in this case was one implying an obligation on the company to exercise the highest degree of care, and to employ the very best possible modern improved appliances, in respect to their teams and cars, to insure the safety of the g neral public. The instruction was:

"If the servants of the defendent, by the use of means then well known, and within their power to employ, could, in a safer way than that used, have managed the horses attached to the car, and thereby prevented the accident, it was their duty to employ such means; and the neglect to do so may well authorize the jury to infer fault on their part!"

The higher court rules that such an instruction was erroneous, and state the law to be as follows:

"If it had been a passenger on one of their cars that was injured, the charge would have been well enough; but as to the case of an individual of the general public, towards whom the company occupied no relation arising out of contract, express or implied, the rule is different, and is thus laid down in *Cleveland, Columbus & Cincinnati Railroad Co. vs. Terry*, 8 Ohio St. 570: 'The degree of care required in such cases of the employes' of the company, 'and also of the party injured, is merely ordinary care and prudence, the perils to be encountered, and all other circumstances under which the injury was inflicted and received, being considered.'"

Negligence—Passengers Standing upon Platform—Rule as to Furnishing Seats.

In the case of *Quinn vs. the Ill. Central Railroad Co.*, the following principles of general interest were decided. The case will be published in 51, Illinois Reports:

"One of a large funeral party, who took passage upon a train to go a distance of twelve miles, was standing upon the steps of the platform of one of the cars, holding on to the railing, when the conductor came along collecting fare. In making change for a bank-note which the passenger paid for his fare, the wind carried away the paper as it was passing from the hand of the conductor to that of the passenger. The latter, in attempting to regain it, and as he was then standing on the edge of the platform, or on the steps, lost his foothold and fell against an embankment, was thrown back under the cars and killed. The cars were quite full, but there was standing-room in all of them. In an action against the company, under the statute, to recover damages for the death of the deceased, it was *held*, it was the negligence of the deceased, not that of the company, which caused his death, and there could be no recovery.

"While it is negligence on the part of a railroad company, for which they should be held strictly accountable, not to furnish comfortable sitting accommodations for their ordinary number of passengers, or even f r an extraordinary number, upon due notice, yet the same strictness should not be applied when a train is unexpectedly crowded by a large party going only a few miles.

"And even if it was the duty of the conductor, in this case, to have advised the deceased to enter the car from the platform, at least while paying his fare, his failure to do so was as nothing when compared with the gross negligence of the deceased."

Negligence in not Ringing Bells—Danger in Walking Upon Tracks—Rule of Damages.

In the case of *Harty vs. The Central Railroad, of New Jersey*, the following general principles have been determined or reaffirmed:

The sole object of statutes requiring bell to be rung and whistle to be blown at the intersection of railroads and highways is to protect persons traveling upon the highway, at or near the crossing. The hazards to be provided against were two-fold: 1st, the danger of actual collision at the crossing; and 2d, that of damage by the frightening of teams traveling upon the public highway near the crossing. Hence the requirement to put up a sign-board. These precautions were not required to be extended to persons traveling along upon the railroads. Under such a statute a company owes no duty to a traveler upon its track to ring a bell or blow a whistle. A person walking upon a railroad track is in a place of great danger, and it is his duty to take even more than ordinary precaution to assure his safety.

Common Carriers are not Responsible for Loss of Goods Caused by Ac of God, i. e., by an Extraordinary Flood. In such cases Plaintiff must prove Negligence—If an Act of Providence is the Proximate Cause, Defendants are not Liable if the Remote Cause was their own Negligence.

The Supreme Court of the United States, in the recent case of *Memphis & Charleston Railroad Co. vs. Samuel Reeves*, have signally decided a principle which has long been maintained, but which, we believe, has never before been brought so directly before the highest court in the land. The substance of the decision is found in the following brief abstract from the decision:

"It was prayed in these words: 'When the damage 'is shown to have resulted from the immediate act of 'God, such as a sudden and extraordinary flood, the 'carrier would be exempt from liability, unless the 'plaintiff shall prove that the defendant was guilty of 'some negligence in not providing for the safety of the 'goods. That he could do so must be proven by the 'plaintiff, or must appear in the facts of the case.'

"It is hard to see how the soundness of this proposition can be made clearer than by its bare statement. A common carrier assumes all risks except those caused by the act of God and the public enemy. One of the instances always mentioned by the elementary writers of loss by the act of God is the case of loss by flood and storm. Now, when it is shown that the damage resulted from this cause immediately, he is excused.

"What is to make him liable after this? No question of his negligence arises, unless it is made by the other party. It is not necessary for him to prove that the cause was such as releases him, and then to prove affirmatively that he did not contribute to it. If, after he has excused himself by showing the presence of the overpowering cause, it is charged that his negligence contributed to the loss, the proof of this must come from those who assert or rely on it."

The Mississippi & Wabash Railroad Company—The Amendatory Act of 1857 Worked a Fundamental Change in the Character of the Original Corporation, and Created Three Distinct Corporations in its Place, viz., The Western, The Central, and The Eastern Divisions—Supervisors in Illinois have no Power to Issue Bonds without a Vote for Each Specific Purpose.

The Supreme Court of the United States, on the 13th of February, in the case of Marsh *vs.* The Supervisors of Fulton County, Ill., delivered an opinion of very great importance and interest in this State, especially as regards the power of municipal corporations, through their agents, to issue bonds. The case went up from the Southern District of Illinois. In brief, the opinion is as follows:

In 1853, the Mississippi & Wabash Railroad Company was incorporated by the Legislature of Illinois, and authorized to construct a road from Warsaw, on the Mississippi, to the east line of the State, a distance of 230 miles. In September, 1853, the voters of Fulton County, Ill., voted to take $75,000 stock in this Mississippi & Wabash Railroad Company, payable in the bonds of the county, subject to certain conditions. The vote was legally had for that specific purpose. In April, 1854, the Board of Supervisors of that county ordered its clerk, who was also County Clerk, to subscribe the $75,000 so voted, and to issue bonds to that amount, upon the fulfillment of the certain conditions. In September, 1855, the clerk was ordered by the said board to enter the subscription on the books of the company, in the name of the County of Fulton. In February, 1857, the Legislature amended the charter of this company, dividing the line into three divisions—the Eastern, Central, and Western—placing each division under the management and control of a board of commissioners to be selected by the stockholders of each division respectively, and also transferring the stock subscribed within these several divisions to the commissioners having charge of said several divisions. In April, 1857, stockholders were elected for the Central Division under the amendatory act. On the books of the Central Division, thus organized, the clerk of the Board of Supervisors of Fulton County made the subscription of $75,000 above mentioned, and in the September following fifteen $5,000 bonds were issued to this division, purporting to be the obligations of the County of Fulton to the Central Division of the Mississippi & Wabash Railroad Company.

The court holds that these bonds were not valid, because the Clerk of the County and of the Board of Supervisors, being a mere ministerial officer, had no authority to bind the county, and because the amendatory act of 1857 having changed the character of the original corporation, and created three distinct corporations in its place, there had been no vote of the county, as by law required, for the issue of these bonds to the *Central Division*. The court further holds that no subsequent act of the supervisors could ratify these bonds because of the general principle of law that an agent, not having the power to do a particular act for his principal, may not give any validity to such an act by its indirect recognition.

LOCOMOTIVE STATISTICS.

Chicago, Burlington & Quincy.

C. F. Jauriet, General Master Mechanic of this railroad, reports for the month of, January ,1871, as follows:

Miles run on passenger trains	109,456
" " freight trains	140,584
" " miscellaneous trains	101,949
Total number of miles run	351,989
Average cost per mile for repairs	12.68 cts.
" " " oil and waste	1.03 "
" " " fuel	9.56 "
Total cost per mile run	23.24 cts.
Engineers, firemen and wipers	7.89 "

The average number of miles run to

Ton of coal	46.46
Pint of oil	17.12

Wood is rated at $6 per cord and coal at $4 per ton, loaded on tenders. One pound of tallow is rated as one pint of oil. The number of locomotives reported is 164. Of these fifteen made no mileage during the month, three are rebuilding, eleven have had general and two light repairs, and one has been engaged on the Quincy & Warsaw Railroad.

Allegheny Valley.

Mr. G. W. Glass, Master Machinist of the company, reports for the month of January, 1871:

The number of miles run by trains was:

Passenger trains	29,550
Freight "	55,086
Ballasting, etc.	1,477
Total	86,113

The cost per mile run was:

For repairs	7.63 cts.
" fuel	5.19 "
" stores	.83 "
Total	13.65 cts.
For engineers, firemen and wipers	8.02 cts.

Average number of miles run to

Pint of oil	20.40
Ton of coal	33.13

The length of road operated is 132 miles. Thirty-six locomotives made mileage during the month.

Chicago, Rock Island & Pacific.

The following is the report furnished from the General Superintendent's office for the month of January, 1871:

ILLINOIS DIVISION INCLUDING PEORIA BRANCH.

The number of miles run by trains was:

Passenger trains	40,709
Freight "	98,315
Miscellaneous "	5,355
Total	144,379

The average cost per mile run was for:

Fuel	7.93 cts.
Oil and waste	.64 "
Repairs	6.37 "
Total	14.53 cts.
Engineers, firemen and wipers	7.14 "

Number of miles run to

Pint of oil	17.58
Ton of coal	41.55

IOWA DIVISIONS, INCLUDING CHICAGO & SOUTHWESTERN RAILWAY.

The number of miles run by trains was:

Passenger trains	42,037
Freight "	80,726
Miscellaneous "	25,184
Total	147,947

The average cost per mile run was for:

Fuel	8.00 cts.
Oil and waste	.67 "
Repairs	6.52 "
Total	15.19 cts.
Engineers, fireman and wipers	7.41 cts.

Average number of miles run to

Pint of oil	17.13
Ton of coal	38.84

The whole number of locomotives owned by the company is 145, of which 75 are on the Iowa divisions and 70 on the Illinois d ivisions. Five locomotives have been in the Chicago shops during the month, one in the Rock Island shops, three in the Davenport shops, two at the Stuart shop, one at De Moines, one at Peoria, and two engaged in Chicago & Southwestern Railway construction.

MISCELLANEOUS.

—The Boston *Traveller* say: "Nearly 50 per cent. more foreign goods have been entered at this port since January 1 than in the same time last year. Our commerce is constantly increasing and extending, notwithstanding the near neighborhood of New York, and the

mighty monopolizing power of that vast city. With the East and West Indies, Africa and Brazil, our trade is making rapid strides of progress. About seventy ships, barks, and brigs are now in port, and more than 100 sail of vessels from foreign ports are on the way to Boston with immense and valuable cargoes. We are pleased to record a great increase in our Calcutta trade; ten ships are now on the way hither, and, at the last accounts, some six or eight vessels besides were loading for Boston. Twenty-six sail of India ships and barks are now on the way to Boston, twenty-one from Liverpool, London, etc., five from the North of Europe, twenty-two from the Mediterranean, and at least twenty vessels from the West Indies and South America."

—The Knoxville & Kentucky and Knoxville & Charleston railroads have made an agreed case with the attorneys for the State. The State agrees to accept from the former eight hundred thousand dollars, and from the latter three hundred thousand dollars, of the bonds of the State, in full satisfaction of the debt which the State has against these roads. Ninety days are allowed within which one-fourth of the amount is to be paid. The stockholders in the former get rid, by this arrangement, of an indebtedness of over two millions of dollars, and in the latter of over half a million dollars.

—The citizens of Ottumwa, Iowa, have appointed a committee of fourteen, to be "charged with the general railroad interests of the city; that it be authorized to negotiate with railroad companies in regard to machine shops, extension of railroads, etc.; that, as soon as possible, said committee shall meet and organize by the appointment of a President, Secretary and Treasurer; that it shall have authority, at any time it may deem necessary, to call meetings of the people, and that we, as citizens, pledge ourselves to respond to said meetings, and, to the extent of our ability and influence, second all its efforts in promoting the best interests and general welfare of the city."

OLD AND NEW ROADS.

Hastings & Dakota.

This road is now completed from Hastings, south of west, to Farmington, and from there, north of west, to Credit River, in all about 40 miles. The Shakopee *Argus* learns that the line, as permanently located, will run in a northwesterly direction from the town of Credit River, and cross Long Lake at the Narrows, about four miles east of Spring Lake. It will then keep on in a northwesterly direction through the town of Eagle Creek to Shakopee.

St. Louis, Council Bluffs & Omaha.

This road, which is in operation from Brunswick to Chillicothe, is graded through Gallatin, to Pattonsburg, Daviess County, and a force is at work tieing and ironing this portion of the line. The line has been located further on to Mount Pleasant, in Gentry County.

Louisville & Cincinnati Short Line.

We learn from a circular issued by the General Passenger Agent, Mr. Sidney B. Jones, that this road has completed its connection with the Louisville & Nashville and the Memphis & Louisville lines, in the city of Louisville, so that passengers by this line will hereafter have no omnibus transfer in Louisville.

Vallejo Railroad.

The San Francisco *Call* says: "It has been stated within a day or two past, that the Vallejo Railroad Company was upon the point of extending its road to Santa Rosa, Healdsburg, etc. Gen. Frisbie, the Vallejo papers say, has transferred to the company real estate to the value of $100,000, which, it is urged, will secure to Vellejo the permanent terminus of the road. We hear of surveying parties in the field near Santa Rosa, in behalf of the Vallejo Company, and that work will be commenced speedily to construct a branch from the Napa line to Santa Rosa, Healdsburg, etc. In the meantime grading is going on north of Santa Rosa by the Petaluma Company."

The Sacramento *Union* says: "Four hundred Chinese went to work on the railway in Sonoma County yesterday, and six hundred more will soon follow them. They will soon grade from Santa Rosa toward Vallejo."

Miami & Erie Canal.

A strong movement to secure the extension and enlargement of the Miami & Erie Canal, to open a water connection with the Ohio River, is now organizing in Ohio, and it is generally believed that the Legislature will authorize the necessary improvements before the adjournment of the present session. The estimated cost of the work is about two millions of dollars, and it is said that the present traffic of the canal will fully justify the proposed extension for its accommodation, even if no new business would be attracted by the improvement; but as the enlargement would so increase the capacity of the canal as to admit of boats one-half larger than those which can now navigate it, a great increase of traffic is anticipated. The connection with the Ohio River would enable canal boats to supply that section of country with coal, and the business of filling the orders of manufacturers and large consumers for fuel now transported by rail will, it is thought, alone necessitate a tonnage movement great enough to pay in tolls an annual interest on the cost of the improvement. The project is entirely practicable, and the prospects of its early completion are thought to be good.—*New York Bulletin.*

Connecticut Western.

The directors held a meeting at Hartford last week. The Boston *Advertiser* says: "It appears that the work is progressing favorably, and all that is wanted now is more ready money from the sale of bonds to push the work to rapid completion. In the purchase of iron the directors save about $86,000 from the estimates. The land damages, however, exceed the estimates somewhat, and the expense of permanent masonry and filling at Whiting River, Canaan, is about $40,000 more than the original estimates."

Toledo, Peoria & Warsaw.

Mr. Secor and Mr. Cruger, President and Vice-President of the company, were at Burlington this week to arrange for building a branch of their road to Burlington during the coming summer. They ask $50,000 from Burlington. The plan is to build about 14 miles of road from LaHarpe, on their present line, to a connection with the Chicago, Burlington & Quincy's Carthage branch, and to run, over their line, into Burlington.

St. Paul & Sioux City.

The Sioux City *Times* has information that during the coming season work is to be prosecuted at both ends of this line; that a large part of the money necessary is secured, and the balance assured; and that cars are to be running over the line within 18 months from April next.

Chicago, Dubuque & Minnesota.

The company has selected a site for the new freight and passenger depot at Dubuque. The grounds include three squares, or about 3⅓ acres, and the building, which will cost between $50,000 and $60,000, is to be used as a union depot by the Chicago, Dubuque & Minnesota, the Chicago, Dubuque & Bellevue and the Iowa Pacific companies. The Dubuque *Telegraph* says the plans are to be made immediately, and as soon as the contract is let the work will proceed.

San Lorenzo Valley.

This California company has been organized for building 16 miles of road up the San Lorenzo Valley, from Santa Cruz to Gold Gulch. The valley is already well settled, and it is expected the road will develop the splendid water power of the San Lorenzo River by affording transportation for lumber. The mountains at the head of the valley are covered with forests of redwood timber.

Oregon & California.

This railroad extends from the city of Portland, Oregon, to the California State line, following for about 150 miles the Willamette River. The Willamette Valley is from 20 to 60 miles wide, very fertile and well settled. The road is finished to the city of Albany, 80 miles, with 20 miles more graded and bridged ready for the iron. The capital of the State—Salem—50 miles from Portland, is located on this line. The earnings for the month of October, when opened as far as Salem, were $18,412.67. The rolling stock consists of 6 locomotives, 7 passenger, 2 baggage and mail, 40 box, and 60 platform cars. The officers of the road are as follows: President, Ben. Holladay; Vice-President, W. L. Halsey; Secretary, A. G. Cunningham; Cashier and Purchasing Agent, Geo. W. Wiedler; General Freight and Ticket Agent, E. P. Rogers; Chief Engineer and General Superintendent, H. Thielsen.

Rockford Central.

The following is the organization of this company recently effected in Rockford, Ill: President, R. P. Lane, of Rockford; Vice-President and General Manager, E. P. Hollister, of New York; Secretary, Hosmer P. Holland, of Rockford; Treasurer, G. A. Sanford, Rockford. Executive Committee, R. P. Lane, Thos. D. Robertson, and E. P. Hollister. Directors, R. P. Lane, T. D. Robertson, R. Emerson, Rockford; C. B. Johnson, New Milford; S. D. Kimbark, James R. Young, Chicago; E. P. Hollister, New York; M. T. Ellenwood, Rochelle, and Franklin Corwin, LaSalle.

Mr. Hollister, the Vice-President and General Manager, represents New York capitalists. From him we learn that a survey of a line from Rockford nearly due south to Mendota, by way of Rochelle, will be made immediately, and that it is intended to construct this part of the line very soon. It is intended to extend from Rockford northwestward to Beloit, Janesville and Madison, and from Mendota both southeastward and southwestward, forming connections with St. Louis and Indianapolis.

Mr. Kimbark, one of the directors, is of the well known iron house of Hall, Kimbark & Co., of Chicago.

Cumberland & Ohio Valley.

A contract has been taken by two well-known railroad engineers of Louisville, for the construction of the road-bed of the Cumberland & Ohio road from its intersection with the Louisville & Cincinnati Short Line west of the Kentucky River, *via* Eminence, Lebanon and Greensburg, to the Tennessee line in the direction of Nashville. The terms of the contract were negotiated by the Executive Committee, in session in Louisville on the 1st of March, where the committee met to receive bids. There were three companies making tenders for the work—one from Canada, Iowa and Kentucky each. The contractors take in pay one-third of the cost in county six per cent. bonds, and two-thirds cash, and subscribe for $300,000 of the stock of the company. The work is to be put under way as soon as the company can arrange the necessary preliminaries, from Eminence to Greensburg, and north of Eminence and south of Greensburg to the Tennessee line, at the option and on the order of the company.—*N. Y. Bulletin.*

New York Central & Hudson River.

It is reported that New York Central scrip issued as an 80 per cent. dividend last year will be retired, and a 6 per cent. first mortgage gold bond issued instead, and that the stock will be made to pay a 10 per cent. dividend, instead of the 8 per cent. that has heretofore been divided on both stock and scrip. This would be, in reality, an increased interest, for the issue of scrip being but 80 per cent. of the stock, 2 per cent. on it would be 1.6 per cent. on the stock. He who held 100 shares of the stock two years ago, and received a dividend of scrip calling for 80 new shares, has been receiving, on shares and scrip, $1,440 per year. If the change spoken of above is made, he will receive $1,000 on his stock and $480 on his bonds.

Camden & Amboy.

This company has erected a fine passenger station at the foot of Desbrosses street, New York, and hereafter passengers who go to New York by way of Philadelphia will be landed either there or at the foot of Courtlandt street, as they may prefer. Baggage will be delivered at Desbrosses street unless otherwise directed. As the Sound steamers start from a point near Desbrosses street, and a street railroad crosses the city on this street, the location is very favorable for an uptown station.

Long Island Railroads.

Several new railroads are now in course of construction on Long Island, and three of them are to be in running order by the Fourth of July. These three lines are—A. T. Stewart's road, a branch road between Winfield and Flushing, and a branch of the Long Island Railroad from Willow Tree to Rockaway. The Flushing & North Shore Railroad Company will construct and operate Mr. Stewart's new road. It is their intention to make an extension to Breslau and Babylon, and also to construct a branch line from Farmingdale to Port Jefferson, on the north side of the island. Every care will be taken in making the new road. Steel rails will be laid on all the curves, and on other parts of the road the rails will be steel-capped and joined by fish-plates. The number of through trains each day will be fifteen, and the time from New York to Hempstead by express trains will be fifty minutes. Special trains will also be run every morning and evening for the accommodation of mechanics, and of those who wish to stay late in the city.

The contract for the grading of the new branch of the Long Island Railroad to Rockaway has been awarded, and will now be pushed forward as rapidly as possible. The survey of the proposed extension of the Northport branch of the Long Island Railroad to Port Jefferson is completed, and nearly all the stock has been subscribed. A double track is to be laid during the summer between Hunter's Point and Jamaica, and a double track is now nearly complete between Bushwick and Pearsall's Corner, on the South Side road. A survey for a proposed extension from Pachogue to Moriches has also been made. Ten new passenger coaches, ten baggage and ten flat cars have lately been added to the rolling stock of the company. During the coming season the company will run hourly trains to Merrick.

The route for the Bay Ridge & Hempstead Plains Railroad has been surveyed, and the grading will soon begin, as the contract for building the road between Valley Stream and Bay Ridge has been concluded, and it is intended to have the road in running order by the end of the year. Right of way through Woodhaven

and some parts of New Lotts has been given to the company.—*New York Evening Post.*

Pittsburgh, Cincinnati & St. Louis.

A correspondent of the Cicinnnati *Commercial* communicates the following with regard to the change in the management of the Pan Handle route, which he gives on the authority of a prominent officer of the company:

"The Pennsylvania Railroad Company, owning and controlling large interests west of Pittsburgh, determined, as developed in the annual report of that company, to organize a company to be located at Pittsburgh, for the management of these interests. In that company both of the Messrs. Jewett were included and assigned important duties. At the conference which resulted in perfecting the organization, H. J. Jewett, from whom active service was expected, did not approve of the organization, and so communicated to the parties who were to constitute it, but at their suggestion took the matter under consideration for his future determination. Some time afterward Mr. Jewett communicated to T. A. Scott, Esq., the President of the Western Company, his final determination not to become a party to the Western organization, thereby declining the position which had been assigned him in that company; and, also, that they might in no way be embarrassed by the same, the mail transmitted to the President of the Pittsburgh, Cincinnati & St. Louis Company his resignation of the Vice-Presidency of that company, notifying Mr. Scott of such resignation. At the annual meeting of the stockholders of the Pittsburgh, Cincinnati & St. Louis Company, subsequently held, both the Messrs. Jewett were elected directors. At the meeting of the directors elect, held on Teusday last, to organize the board, H. J. Jewett, by a note addressed to the Secretary, declined to be qualified as a director, and upon such action being taken upon his part, T. L. Jewett declined serving any longer as President of the company."

Columbus & Circleville.

This company has lately been reorganized to build a road from Columbus south, about twenty-five miles, to Circleville, in Pickaway County, on the Cincinnati & Louisville Railroad. The capital stock is $500,000.

Richmond & Petersburg.

The Virginia Legislature has passed a bill for the sale of the State's interest in this road ($500,000) to H. H. Ellison and others. This, it is understood, gives the control of the line to the Pennsylvania Railroad Company.

Ohio & Mississippi.

This company is preparing to change its gauge from 6 ft. to 4 ft. 9 in. Changes in the rolling stock are now being made and forty new locomotives are contracted for to be delivered in July. By the end of that month it is intended to have the gauge changed. It will then form the western section in a short line from Baltimore to St. Louis.

MECHANICS AND ENGINEERING.

Detroit Bridge & Iron Works

The bridge of the Toledo, Wabash & Western Railway, at Defiance, Ohio, which was burned last December, has been replaced by one from the Detroit Bridge & Iron Works. The contract was signed on the 2d of January, and in 49 days from that time an iron bridge of four spans, 151 feet each, was completed and ready for use.

Narrow Gauge in Massachusetts.

A joint committee of the Massachusetts Legislature has reported a bill authorizing the construction of narrow-gauge roads in the State, which provides that "any branch railroad hereafter constructed in the State, may adopt a gauge of three feet or the existing gauge of four feet eight and one-half inches, and no other gauges shall be used. Any association of persons, a majority of whom shall be citizens of the Commonwealth, and all of whom shall be citizens of the United States, is authorized to locate, construct, maintain and operate, within the limits of any town in the State, a branch railroad with a gauge of three feet, with suitable tracks, stations and equipage; provided, that at a meeting of the legal voters of said town, two-thirds of such voters shall authorize the construction of the railroad. Upon recording articles of association, the company shall become a body corporate, with all the powers and privileges, and subject to the duties and liabilities affecting railroad corporations. Any railroad corporation now established may locate and may maintain as a part of its railroad system, one or more narrow-gauge branch roads, provided the county commissioners where the road is to be located determine that the public convenience or necessity require it."

Omaha Bridge.

But one pier of this bridge, which the American Bridge Company are constructing, remains to be begun, and the entire substructure is so far advanced as to warrant the delivery of all the superstructure the present season—one span to be delivered on the first of May, and afterwards at the rate of one and one-half spans per month until the eleven spans are delivered. It is expected to have the bridge completed the present year.

Leavenworth Bridge.

The trestle-work approaches to the bridge are completed and all the columns of the two piers are above high-water mark. The bracing and masonry of the piers between high-water mark and the bridge seats are rapidly approaching completion, and the contractors (The American Bridge Company) expect to have all the substructure finished by the first of May, and are prepared to place the truss in position and finish the entire work within the next six months.

Defects in Rolling Stock.

A correspondent of the *Mechanics' Magazine* says that in Bavaria "one of the rules of the railway system is "to the effect that a reward, varying in amount from "half-a-florin (10d. sterling) to one florin and a half (2s. "6d.), according to the importance of the case, shall be "paid to every man employed in the stations, or on the "lines, who discovers and makes known a flaw, defect, "or break in the axle, axle-holder ('bandage'), or spring "of any carriage or engine attached to a train; or a "defect or break in a coupling-iron. Recent events "have shown us that we must at least respect the Ger-"mans. They seem to manage their siege trains pretty "well. May we not borrow a hint from their system of "management of railway trains?"

A Single Rail Tramway.

Mr. J. L. Haddan, C. E., proposes to construct a single line tramway for the conveyance of goods and minerals through rough and hilly districts where there are no regular roads, in the following manner: The rails are to be composed of iron bars, bolted down upon a continuous wooden sleeper. The vehicle is to have one, two, or more wheels behind one another, with flanged tires so as to keep the vehicle on the track. From each side of the frame he proposes to have one or more beams, or, more properly speaking, yokes, to which the draught animals are to be secured. The yokes preferably pass over the animals' backs, to prevent the vehicle toppling over; by this means, should one of the animals stumble, and bring his side of the vehicle down, he is brought on his feet again by the counterpoise or weight of the animal on the opposite side.

In many parts of Europe we believe the invention will find much favor, particularly in the mining and agricultural districts of this country, such as Northumberland and Lincolnshire, and even in Kent, where large quantities of grain, hops, and manure have to be moved from place to place; in fact, there is an endless variety of purposes to which it could be applied, not only in the open, but in closed places—in warehouses, for instances, where bales and heavy weights have to be moved about. Here the vehicle would be something like a bicycle, with a suitable space between the wheels; the backbone, or beam, could have hooked chains or slings hanging from it, upon which the bale or other article could be placed by tilting the vehicle to one side, when, by exerting a slight power on the upright pole or lever, the vehicle would be brought upright with the weight lifted off the ground and hanging to it. Of course, in large establishments, branch rails or sidings could be laid, so that the weight could be deposited at any desired spot with facility.—*Mechanics' Magazine.*

ELECTIONS AND APPOINTMENTS.

—Mr. John Parks has been appointed Superintendent, Mr. William Warmcastle, Assistant Superintendent, and Mr. D. H. Cady, Treasurer of the Union & Titusville Railroad Company. Mr. Parks has resigned his position as Division Superintendent of the Erie Rranch to accept his present position. The other general officers are: W. H. Abbott, President; D. H. Cady, Vice-President and Treasurer; Henry Harley, General manager

—The incorporators of the Winona & Southwestern Railroad Company met at Winona last week and elected the following directors: John Robson, William Windom, William Mitchell, M. G. Norton, E. S. Youmans, H. W. Lamberton, R. D. Cone, M. K. Drew, H. D. Huff, Thomas Wilson, J. W. Sprague, H. M. Burchard, Thomas Simpson. The following officers were elected: President, John Robson; Vice-President, William Windom: Secretary, William Mitchell; Treasurer, Mathew G. Norton; Executive Committee, John Robson, H. M. Burchard, Thomas Simpson.

—Mr. Lewis Troost has been appointed Consulting Engineer of the Mobile & Northwestern Railroad Company.

—The following officers have been chosen by the directors of the Pittsburgh, Cincinnati & St. Louis Railway Company: President, Thomas A. Scott, of Philadelphia; First Vice-President, H. M. Thrall, of Pittsburgh; Second Vice-President, E. W. Woodward, of Cincinnati; General Manager, J. N. McCullough. of Pittsburgh; General Ticket Agent, F. E. Myers, of Pittsburgh. This is an entire change of officers.

—A telegram from St. Louis reports that John Ross, of Vincennes, Ind., and Charles Parsons, of St. Louis, have resigned their places as directors of the Ohio & Mississippi Railroad Company, and that Daniel Torrance, of New York (director New York Central & Hudson River Company, and son-in-law of Vanderbilt), and John King, Jr., of Baltimore (Vice-President of the Baltimore & Ohio and President of the Marietta & Cincinnati), have been chosen as their successors.

—The Atchison & Nebraska Railroad Company, on the 7th inst., elected the following directors: Nathaniel Thayer, J. A. Burnham, J. H. Beal, W. F. Weld, Geo. Putnam and C. F. Adams, of Boston; J. F. Joy, of Detroit; A. Byram, G. W. Glick, P. T. Abell and W. Cochrane, of Atchison.

Local Aid to Railroads.

Mr. Charles Reemelin, of Cincinnati, who has studied much and written something on the relation of railroads to the community, has proposed a scheme for encouraging the construction of railroads in Ohio in a communication to the Commissioner of Railroads, and Telegraphs, of which the following is a part:

"Let a statute be enacted authorizing the Commissioner of Railroads and Telegraphs, on the request of any ten or more persons, or the boards of county commissioners of the counties, or the city council of one of the cities in the State, to appoint, by and with the advice and consent of the Governor, an experienced engineer and assistants, whose duty it shall be to survey, determine the kind of road to be constructed, and prepare estimates for any railroad proposed by the persons or public authorities aforesaid, they giving security that they will, in case of subsequent failure, pay the expenses of said survey, etc.

"Let it be made the duty of said engineer to report his proceedings within a given time to the State Commissioner aforesaid, including profile of the road and full estimates of cost, the latter to be published and the former to be filed.

"Let it also be made the duty of the respective county auditors to prepare from the records in their offices, and otherwise, if necessary, a register of persons who hold lands or buildings, or who have households, stores, mills, factories, or other property, within a range along the proposed line, to be named in the law, or in the cities or towns at the termini, and such other facts as the law may require, or the State Commissioner aforesaid may order, with a view to fair after-assessments.

"Let it be made the duty of said Commissioner to examine carefully the report of the engineer and the registers aforesaid, and to correct all mistakes either from his own knowledge or on the request of persons interested, and from them make lists or registers by townships and precincts, or wards, of the persons proposed to be asssessed for the contemplated railroad.

"Let the Governor, upon the written opinion of said Commissioner, stating that said profile, estimates and registers are, in his opinion correct, invite proposals from any existing or proposed to be incorporated railroad company upon what minimum of public money and upon what minimum rates for freight and passengers they will construct, equip and run the contemplated railroad; naming in their bid also, the frequency of trains which they stipulate to have on the road.

"These proposals being in, they should be opened by the Railroad Commissioner in the presence of the Governor and a limited nnmber of persons in interest, and the two State officers shall determine which is the lowest and best bid. And thereupon an election shall be held, at which all proposed to be assessed, and no other persons, shall be qualified to vote, and if at this election a majority of the persons assessed, carrying also a majority of the voting places, shall approve the said railroad project, including a perpetual lease, upon the terms thereof, then the amount necessary shall be assessed by the State Commissioner aforesaid, and bids for the same in thirty-six monthly installments shall be made out and given to the railroad company whose bid was accepted, which shall then be authorized to collect the same as assessments are collected in cities.

"Provision should of course be made assessing the property around depots and stations higher than other property, and so should all other persons be rated higher who shall be more favorably situated to the contemplated railways than others. Appeals to the proper courts of justice should also be allowed, with other remedial measures."

The assessment is to be made on a class, because it is supposed that the chief benefit of the railroad will be reaped by that class; but, in addition, Mr. Reemelin proposes that the State and county contribute limited amounts—say $1,000 per mile from the State and $500 per mile from the county—for the general benefits of the line, to be paid by a general tax.

—Mr. Beverley R. Keim, General Ticket Agent of the Kansas Pacific Railway, has his headquarters, since March 15, at Kansas City, Mo., instead of at Lawrence, Kansas.

RAILROAD GAZETTE

PUBLISHED EVERY SATURDAY.

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Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the Railroad Public in affording us the material for a thorough and worthy Railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Engineering and Mechanics.—Mr. M. N. Forney, Mechanical Engineer, whose office is at Room 7, No. 72 Broadway, New York, has been engaged as Associate Editor of this journal in charge of these departments. He is also authorized to act as our agent.

Removal.—The office of the RAILROAD GAZETTE *is removed to Nos.* 110 *and* 112 *Madison Street.*

☞ *Our Prospectus and Business Notices will be found on the last page.*

VOLUME TWO.

With this number closes the second quarto volume of the RAILROAD GAZETTE. It is now just a year since the publication of this journal in its present form was commenced. Its progress since that time has been most satisfactory. We have subscribers in every State of the Union, in England, France, South America and China, and the increase is constant—quite as rapid now as at the beginning of the first volume. We have almost every week an addition to our contributors, and we are able to make our discussions of railroad matters fuller and more complete every succeeding month. We have the co-operation and assistance of some of the most capable officers and engineers in the country, and have received the most flattering commendations from great numbers of those whose approval is worth most. As our patronage increases, we intend to improve our journal, for we acknowledge readily that there is abundant room left for improvement.

We are prepared to make the next volume better than its predecessor. A change will be made in the arrangement of the advertisements which will, we think, be welcomed by all our readers, while it will give a much better display of the advertising than heretofore. More and better engravings will be given. The department of railroad law, which is of value to every agent or employe who has a contract to make, as well as to directors and officers, will be continued. The other departments of railroad news will be be made as full and accurate as careful editing and the aid of a very large number of correspondents can make it. Engineering and mechanics, as applied to railroads, will receive their full share of attention; and no pains or expense will be spared to make the RAILROAD GAZETTE indispensable to every railroad man, as so many of our partial friends in all parts of the country and on almost every American railroad say that it is to them now.

WARMING AND VENTILATION OF RAILROAD CARS.

[Continued from Page 563.]

In our last article on this subject, we showed that with the ordinary manner of warming and ventilating cars there is often a difference of from 40° to 50° in the temperature of the air at the floor and at the roof, and that this difference is caused by the admission of cold air into the car and exhausting the warmed air from the top. We have also shown that it is impracticable to admit any considerable quantity of cold air without much discomfort to the passengers. Supposing now that instead of admitting the air either under or above the door that we open the window *A*. fig. 6, immediately in front of the stove, and close the inside blind. As we have explained before, when the car is running in the direction indicated by the dart, the air will enter through the window and will receive an upward direction from the slats in the blind, and as it passes over the stove will be warmed, and the current being directed above the heads of the passengers no draft or cold air will be felt by them. If the ventilators *v*, *v*, *v*, in the roof are now opened, the warmed air will at once escape through them, especially if, as is often the case, they are so arranged that the car creates a considerable exhaust current. The cold air in the bottom will thus remain undisturbed, very much to the discomfort of the passengers. If now we close the ventilators at the top and make an opening under the

Fig. 6.

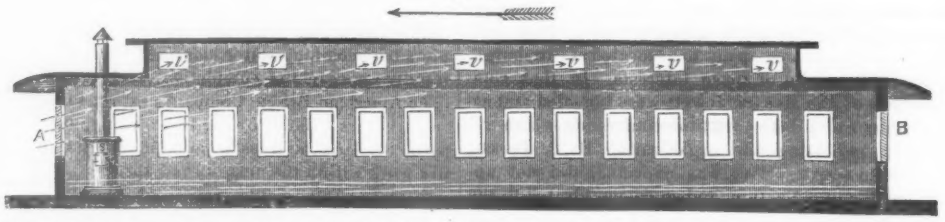
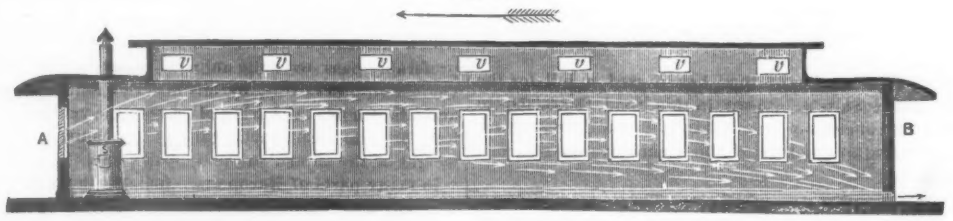


Fig. 7.



back door, *B*, fig. 7, the partial vacuum behind the car produced by its motion, will cause an outward current *at the bottom*, thus exhausting the stratum of cold air, while the warmed air will gradually take its place. As there is usually no provision by which an opening can be made below the door for the escape of the air, we must resort to the next best thing at our command, which is one of the rear windows. By opening that so as to allow the air to escape while admitting it at the front window, a car can usually be ventilated tolerably well. Closing the blinds hides the fact that the window is open, to which, and to fresh air, many people seem to have the same antipathy that mad dogs have to water. Where no other good arrangement is provided, this can be resorted to usually with good results. It requires, however, considerable persuasive power to influence the conductor to adopt this plan. They and the brakemen are usually ignorant of the fact that a car can thus be ventilated and at the same time be kept comfortably warm. As a very inexpensive and, to a certain extent, effectual method of improving ventilation in cars which have no provision for supplying fresh air, we suggest the posting of a card over the end windows with the following instructions in conspicuous letters:

TO VENTILATE THE CAR IN WINTER.

Open the Window in Front of the Front Stove, and the One behind the Rear Stove, and CLOSE their BLINDS *

This plan of ventilating we have tried and have found it to be quite effectual under most circumstances. It is, as we have said, often difficult to induce those who have charge of the cars to try it, but by delivering very popular lectures on the subject to the brakeman, we have nearly always been able to prevail on him to make the experiment. If authoritative instructions were given them in the way proposed, it would no doubt at least help to bring about some improvement where now it is so much needed. It would, however, only relieve the evil, and not or car is cold. That cold air may be fatally impure, is a truth which we suppose may be universally believed, in some future millennial period; but so far as our relations to the present subject are concerned, it may be assumed that this ignorance is one of the unalterable elements of the problem. The fact that people might, could, would, or should know better, ought not to influence us. The broad and very palpable fact is, they *do not know better*, nor is there any reason to think that in the aggregate they will, in our time, at least, be better informed on the subject. We must, therefore, adopt some means for both *supplying* and exhausting a sufficient quantity of air, which will be entirely automatic and arranged so that it will be impossible to shut off the supply. There must at the same time be ample provision for warming it, and as any considerable current, either warmer or colder than 70° is unpleasant, the supply should, as far as possible, be distributed in small quantities through the whole car. If it is not, the persons who are nearest the place when it is admitted will be either uncomfortably warm, while others are too cold, or *vice versa*. Besides this, many persons have a mortal fear of a "draft," as though a current of air were laden with deadly poison. There is, of course, under this feeling some basis of truth, as there is in most error; but the people who have the dread lose sight of the other fact, that in the air "death lurks most where stagnation reigns supreme."

In the ventilation of buildings, two systems are used for producing a movement of air. In one it is produced by forcing the supply into the room by mechanical means—such as a "blower" or fan, and leaving it to escape by apertures which are either accidental or are provided for the purpose. This is called the *plenum* method.

In the other system the movement is created by *exhausting* the air, and this is called the *vacuum* method. A current is produced by the natural tendency to rise which warm air has. The power which it will thus exert is in proportion to the height of the column or of the flue or duct in which it is contained. As in most cases it is impossible to have a flue extend

* This suggestion is made on the supposition that there are two stoves, one at each end of the car.

more than a few inches above the top of the car, this latter system cannot be used in railroads, and the complication of mechanical means, such as fans or blowers, for forcing air into a car, would be an insuperable objection to their use. Fortunately, the motion of a car furnishes abundant means for creating either a "plenum" or "vacuum" movement in the air. Therefore in nearly every plan thus far put into practice, this power alone has been used for exhausting the air and also for supplying it where any provision at all has been made for the latter purpose.

Fig. 8.

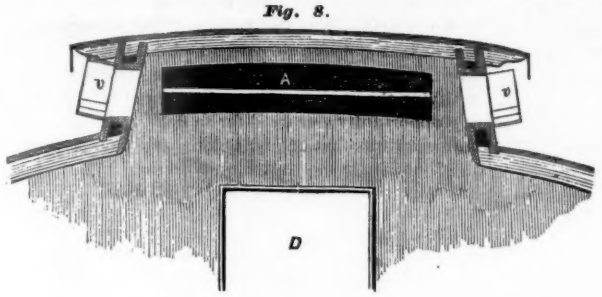
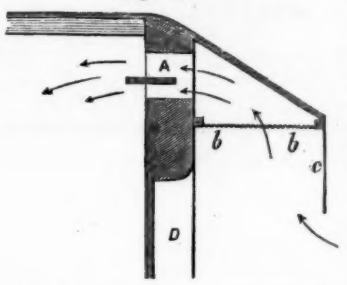


Fig. 9.



A description of all the devices which have been used for exhausting air from cars would fill a large book, and though it might be interesting as illustrating the ingenuity of the contrivers, it would assist us very little in learning how to keep the air pure, for the reason that nearly all of them were based upon the idea of taking the air out of cars *without putting any in.* There is not much trouble in getting air out of a car, if there is an abundant supply admitted. The difficulty is chiefly in supplying the air so as not to be disagreeable or uncomfortable to the passengers.

The objections to admitting the air through the front windows have been referred to. In dry weather the dust which rises between the cars would be very disagreeable if the air was taken in at the window over the platform. A plan shown in figs. 8 and 9, now used on the New York & Harlem, New York Central and other roads, avoids this difficulty to a considerable extent. Fig. 8 is an end view looking from the inside of the car, and fig. 9 a longitudinal section showing the arrangement. The raised roof is carried out over the platforms and has an opening, *b, b,* covered with wire cloth. It communicates with the inside of the car by another opening, *A,* which can be closed by a door, pivoted or swung on its center. *C* is a sheet iron apron around the projecting roof. The opening *b b* is so high above the platform that very little of the dust rises up to it and it is protected from the cinders from the engine by the apron. The wire cloth is also supposed to exclude some of the dust and cinders. At least the heavier particles of the dust will not rise with the current of the air and are thus excluded. The door *A* swings on its center and can, of course, be opened and closed at pleasure. The motion of the car creates an inward current at the front end and an outward current from the rear end, thus creating a movement of the air through the whole length of the car. In comparatively mild weather this would answer excellent purpose, but when the temperature outside is down to the freezing point, or below, very few of the passengers, especially those near the front end of the car, would tolerate having these ventilators open. The air which enters at the window in front would fall on those near it with a sharp, chilling sensation, which would be very disagreeable. It therefore cannot be depended upon as a means of supplying air at all times, but as an auxiliary for admitting cold air at one end and exhausting hot air at the other when the car is too warm, it serves a good purpose, even in the coldest weather. This plan is used on many of Wagner's cars on the New York Central, and has just been adopted by the New Jersey Central, New Jersey Railroad & Transportation Company, the Erie and other roads. Where this arrangement is used it would be a good idea, we think, to paint in large letters over the door *A* the first line of the inscription given below, and on the door itself the injunction which follows, so that when the door is closed it would read:

IF THE CAR IS TOO COLD CLOSE THIS VENTILATOR,

But if You Want to Breathe
PURE AIR
Request the Conductor to Open It.

So long as the ventilator is open, the portion of the inscription on the door will be out of sight, but as soon as it is closed, the injunction will be seen of all men. Our impression is that with this device, if conductors did not habitually keep the ventilators open they would be made quite unhappy by the clamor of passengers.

Many of the old Woodruff sleeping cars had a sliding sash in the door, which is better than no provision at all for admitting air, but is very apt to be troublesome on account of dust. But the quantity of air admitted by either plan will vary very much. With a strong side wind or one blowing in the same direction in which the train is running, very little air will enter the car, while if it was blowing directly facing the train, *too much* would come in, especially in cold weather. The fact that all the air which enters the car by this means is cold, is the great objection to both these plans, if they are the only means of supplying the car

As we have pointed out before, it will be impossible to admit the requisite quantity of air into a car (1,000 cubic feet per minute) in very cold weather without much discomfort to passengers, unless the air is warmed before it enters. Of the means for doing this we will speak in our next.

[Since the articles preceding this were written we have received the report of the State Board of Health of Massachusetts, which contains some very suggestive remarks on "The Ventilation of School Houses" and the "Impurities of Air," which we re-print in another column.]

[To be continued.]

Resignation of John M. Douglas.

Mr. John M. Douglas, for six years past President of the Illinois Central Railroad Company, has resigned, and his resignation has been accepted. Mr. Douglas first tendered his resignation three months ago, by his physician's advice, on account of illness. His resignation was not accepted, but as his disease (neuralgia) became more severe, he renewed it. It was then accepted on condition that he should remain in the Directory, and, after six months' leave of absence, accept the office of Counsel to the company.

Mr. Douglas entered the service of the Illinois Central Company in its early days, in 1852, when the road was in course of construction, as attorney for the company. He was then a young but prominent lawyer in Galena, where so many of the ablest men in the State lived twenty years, or more, ago. Mr. Douglas remained in Galena until 1855, when he removed to Chicago. In 1860 he was elected Vice-President of the company, and held that office until 1864, when he was chosen President to succeed Mr. W. H. Osborn, who had occupied that office for the preceding ten years and is now Secretary of the company. Mr. Douglas' administration has been very successful. Under it the road has paid ten per cent. dividends, in cash, yearly, and also one 10 per cent. and one 8 per cent. stock dividend. At the current price of Illinois Central stock this is equivalent to an income of 14 per cent. per year on the stock. During the same time the company has added greatly to its lines (by lease), greatly improved its connections, and added nearly 80 per cent. to its rolling stock.

Mr. Douglas' successor is not yet elected—at least his election has not been announced.

Accidents on English Railroads.

An official report to the Secretary of the Board of Trade of the United Kingdom gives a general account of the railroad accidents in the kingdom during the year 1870. According to this, 286 persons were killed and 1,239 injured by such accidents during the year; 90 of those killed and 1,094 of those injured were passengers, and of these 66 were killed and 1,084 injured from causes beyond their own control.

The estimated number of passengers carried, or of journeys made, during that year is 307,000,000; so it appears that one passenger out of 3,410,000 was killed, and one out of 281,000 injured.

By the report of the Massachusetts Railroad Commissioners for the year ending September 30, 1870, the proportion of injuries, fatal or otherwise, to passengers was one to 727,104; on the English roads it was one to 250,845.

By the report of the State Engineer and Surveyor of New York for the year ending September 30, 1869 (the last published), the average number of passengers carried to one killed was 904,704; the average number carried to one injured, 248,793.

The average on the English roads is unusually great. For the five years past one passenger in 13,000,000 was killed, and one in 372,000 injured. The numbers of injured reported on the American roads is so small that we suspect that they are not very accurate.

A Canard.

One of our city papers recently announced that James F. Joy of Detroit, President of the Michigan Central, the Chicago, Burlington & Quincy, and several other railroad companies in the West, was about to resign and withdraw from active railroad management altogether. As Mr. Joy manages one of the largest systems of railroads in America—next to the Pennsylvania system *the* largest, we believe—and has been all the time one of the most active, energetic and successful of managers, this announcement was more than astonishing. It turns out, however, that Mr. Joy is not yet superannuated, and does not propose to retire from business. The foundation of the report, probably, was in his expressed intention to transfer the management of some of his western companies to some of his associates and relieve in a measure his cares, which have become altogether too numerous and too weighty for any one man.

The Railroad Fare Bills.

The Lower House of the Illinois Legislature refused even to consider the Senate bill known as the "three cent" bill, but has taken up and passed the bill reported by its own committee, which provides for graduated charges of from 2½ to 5½ cents per mile, according to the earnings of each road per mile. This bill now goes to the Senate, which may possibly pass it, but is quite as likely to insist on the "three cent" bill. The result, very likely, will be a failure to pass any bill, which is a calamity that railroad companies and their patrons alike can afford to submit to with perfect equanimity.

The Pennsylvania Company.

This corporation has been managing the lines of the Pennsylvania Railroad Company west of Pittsburgh since the first inst., but the details of the organization are not yet arranged. Mr. McCullough's appointment as General Manager and Mr. Myers' as General Ticket Agent have been announced, but the other appointments in the ticket and passenger department are not yet announced. They will probably be published after the session of the General Ticket Agents' Association.

The Illinois Central Report.

We give elsewhere the report of the President and the most important part of the General Superintendent's report, but as it reaches us just before we go to press we are compelled to omit many important parts, and forego all comment, not having had time to make any examination of it.

NEW PUBLICATIONS.

Album of Designs, Showing Various Styles of Iron Railway Bridges.—Messrs. Clarke, Reeves & Co., of the well known Phœnixville Bridge Works, have issued a work with the above title to illustrate the various styles of bridges which they construct. It contains nine large sheets, each 11 inches by 20, of lithographic plates, showing bridges in such detail as to make quite clear the peculiarities of construction, the proportions of parts, etc. For instance, the first sheet illustrates a rolled iron girder bridge and a trussed iron girder bridge. Of the first a longitudinal elevation, a plan, and two cross sections are given. Of the latter an elevation of a 30 ft. and one of a 45 ft. span, a plan and a cross section are shown. These are the simplest designs given. The others are of trussed girder spans of 45 to 75 feet; "Phœnix deck truss" of 100 feet span; the same with 160 and 58 feet spans; "a low Phœnix truss;" a "high Phœnix truss," for single track (112 feet span); the 185 ft. span of the Hudson River Bridge at Albany, now in course of construction; the draw of the same bridge which is 274 feet long; a draw 127 feet long on the Philadelphia, Wilmington & Baltimore Railroad; plans and sections of turn-tables of these draws; two designs for road bridges over railroads; small viaduct for carrying railroads over roads and streams; viaduct on screw piles over bad foundations, on which no masonry is required; and a double sheet elevation of a wrought-iron viaduct 585 feet long crossing navigable water.

Nearly all these designs are of works actually constructed by this company. They must aid materially those who have to select designs and let contracts. We should have said that the designs are prefixed by short descriptions, the specifications for the bridges constructed by this firm; a list of works constructed by them, and a comparison of trials of Phœnix and Keystone columns.

Manual of National, State and Railroad Indebtedness.—Under this title Messrs. Condict & Co., well known bankers

of New York, have issued a thin octavo volume of 67 pages. It gives a statement of the indebtedness of each State, with the amount issued of each separate debt, the purpose for which issued, the amount outstanding, when and where payable, rate of interest, etc. A very elaborate statement of the United States public debt, covering fourteen pages is added, from which it appears that our debt is represented by thirty-eight different kinds of securities. Only a double page sheet is devoted to railroads, and this gives the mileage, bonded debt, floating and other debts, debt per mile capital stock, and stock per mile of fifty different roads.

The statement of capital represented by a mile of road is very interesting. We give some of the leading lines: Central of New Jersey, $257,403; Morris & Essex, $221,900; Atlantic & Great Western, $220,941; New Jersey Railroad, $208,824; Philadelphia & Reading, $179,715; Delaware, Lackawanna & Western, $173,434; Pennsylvania Railroad, $146,952; New York Central & Hudson River, $143,236; Central Pacific, $133,428; Erie, $123,859; New York & New Haven, $113,895; United Companies of New Jersey, $103,957; Boston & Lowell, $101,402. Thus thirteen of the fifty have a capital of more than $100,000 per mile. Our leading Western roads make a very different showing, as follows: Michigan Central, $60,181; Lake Shore & Michigan Southern, $62,148; Milwaukee & St. Paul, $37,060; Chicago & Northwestern, $60,918; Chicago, Burlington & Quincy, $50,289; Chicago, Rock Island & Pacific, $42,005; Chicago & Alton, $40,809; Illinois Central, $62,516. The lowest are in the South, as: Savannah & Charleston, $20,576; Mobile & Ohio, $26,610; Mobile & Montgomery, $24,479; Louisville, Cincinnati & Lexington, $26,173; Greenville & Columbia, (S. C.), $21,418; Georgia Railroad, $20,836; East Tennessee, Virginia & Georgia, $27,520.

Chicago Railroad News.

Canal Opening.

Mr. W. A. Gooding, General Superintendent of the Illinois & Michigan Canal, announces that navigation will be open on that part of the canal between LaSalle and Joliet on the 25th inst. (to-day). Boats will be allowed to draw 4 ft. 6 in. until otherwise ordered.

On Time.

Monday evening, March 20, as the six o'clock whistle sounded, Mr. Robert Fair, Superintendent of Car Repair Department, Michigan Central Railroad, was notified that some persons wanted to see him on business in the shops. On entering he was signaled by the Foreman, who freighted Mr. F. with a magnificent silver service and a set of fine jewelry, the gift of his associates, as a token of their regard and esteem for him as a gentleman and skillful mechanic. Mr. Fair, though taken by surprise, soon recovered and took the "inside track," saying that, as he was transferred to the Air Line Division of the road, his business connections with them would cease on the 30th, but his friendship would always remain, and their kind act would be his "head-light" until he was "ditched" or "went out of commission," and his "ties" were broken forever. Members of several departments of the road were present, and all joined in wishing the happy recipient success and prosperity in his new position, which is one of the most responsible on the road. Although a young man, he has, by strict attention to his manifold duties, risen step by step until he has won the confidence of all.

Personal.

It is our loss, though their gain, that two of our prominent railroad men have been lately promoted to positions of the very highest rank in their line. One of these is Mr. Thomas L. Kimball, who has long represented the Pennsylvania Railroad in this city, for some time being its General Western Passenger Agent, with jurisdiction from Pittsburgh to San Francisco and from St. Paul to New Orleans, who has been appointed General Ticket Agent of the Union Pacific Railroad. The new President, Colonel Scott, as Vice-President and the active manager of the Pennsylvania Railroad has had abundant opportunity to become familiar with Mr. Kimball's remarkable ability in his position, and this appointment shows that he appreciates him.

The other person to whom we refer is Mr. F. E. Myers, who for many years has been General Ticket Agent of the Pittsburgh, Fort Wayne & Chicago Railway, and is known throughout the country as one of the ablest men acting in that capacity. His new appointment is as General Ticket Agent of the "Pennsylvania Company," which gives him charge of the ticket business on all the leased lines of the Pennsylvania Railroad Company west of Pittsburgh, embracing more than 2,000 miles of road. Mr. Myers has had his office here only for about a year—long enough, however, to make us very sorry to lose him.

Mr. Myers has removed his office to Pittsburgh. Mr. Kimball will have his headquarters at Omaha, and will be established there after his return from the General Ticket Agents' Convention at Savannah, at which he will represent the Union Pacific.

The office of General Western Passenger Agent of the Pennsylvania Railroad is abolished.

—The Monadnock (New Hampshire) Railroad Company recently sold the balance of the stock—something over $30,000—subscribed, and not paid, by public auction. The shares of $100 brought about $60 each on the average. Within the past week, suits at law have been begun against the original subscribers for the balance of $40 a share.

Contributions.

A FEW SEASONABLE HINTS TO RAILROAD MEN.

BY WM. S. HUNTINGTON.

The season is now at hand when it behooves railroad men in all capacities to be exceedingly vigilant and continually on the lookout for disaster. There is no season of the year when so many unforeseen accidents occur as at this. It is true that at other periods we have railroad accidents of a serious nature, but at no time of year is it as necessary for *all* railroad men to exercise as much care to prevent accident as now. A careful review of railroad accidents will reveal the fact that a majority of fatal disasters have occurred in the spring months. This is caused mainly by the action of frost; or rather by its *reaction* on permanent way. These accidents are so numerous and their character so various that it would be preposterous to say that they could all be prevented by any amount of watchfulness on the part of employes. We, however, hazard nothing in saying that a good share of the worst railroad accidents at this season of the year may be prevented by an increased watchfulness on the part of officers and employes.

I hold to the doctrine that a certain share of mortality to railroad passengers is due to causes beyond the control of human agency, and therefore I consider that under some circumstances railroad managers are wrongfully blamed; but that there are many lives lost and much property destroyed by neglect on the part of these men, no one will deny. But in accordance with the view that many serious disasters may be prevented by proper and increased watchfulness at this season, I propose to offer some hints on the subject which may not be out of place.

A large share of the railroad accidents at this season of the year are caused by the spring freshets, and these sometimes come so suddenly that the utmost vigilance will not prevent accident. This may seem rather a broad statement to some, but there are many old railroad men that have seen a storm of a few minutes duration of such severity as to open frightful chasms in embankments and undermine bridges and culverts almost in the face of passing trains. The sudden breaking away of frost under trains passing over track that has been badly heaved by frost is also a frightful source of mischief at this season and the greater share of responsibility rests on the track-men, as it lies greatly in their power to prevent accident, by giving engineers timely warning of danger in such places. Engineers are not expected to know at what particular point danger may be expected, but they should be particular to notice every motion or gesture of track-men by day or of lights by night, as it is frequently the case that danger is discovered by them (the track-men) under circumstances which render it impossible for them to display any *regular signal of danger*, and they are obliged to resort to any means they can invent to call the attention of train-men to "danger ahead."

Trains have on more than one occasion been brought to grief by engineers not giving proper heed to night signals of danger, for the reason that the customary *red light* was not displayed. Now it frequently happens that a sudden storm renders it necessary for section men to show a signal of danger in more than one place at a time, and it sometimes happens at such times that an inexperienced man is sent with a *white light* to stop a train and fails through ignorance of the course to pursue to stop the train in time to prevent accident. Although it is annoying for an engineer of a fast train to stop oftener than is necessary, it is best at this time of year to take notice of all unusual lights and "be sure they are right" before going ahead.

When the frost is coming out of the ground a little washing sometimes causes mischief that at other times would be hardly noticed; that is to say, that huge boulders are sometimes loosened from their bed and precipitated upon the track at this season by a light-shower which would not obstruct them at other seasons. Water courses which are partially obstructed so as to change the course of the current and throw it agains an embankment should receive proper attention. Masses of ice frequently lodge against piers and abutments until a dam is formed, which, in breaking away, carries everything before it. A few minutes' work cutting ice so that it can pass a bridge may save thousands of dollars. A little drift-wood lodging in a culvert has on more than one occasion been the cause of frightful disasters. The washing away of a single yard of ballast is sufficient to destroy a train, and at this time of the year a few gallons of water is sufficient to do it.

A great deal of railroad property, fences, farm buildings, etc., are destroyed by fire in the spring months. The dry grass at the road side takes fire more readily now than at any other time, and a single spark from a locomotive, if not attended to, may destroy thousands of dollars' worth of property. Train-men may do much to avert disaster by calling the attention of track-men and others to anything that may lead to danger or the destrustion of property. And here lies the real cause of much trouble, *i. e.*, in not attaching sufficient importance to matters that seem of no account or not worthy of attention. It will hardly be supposed that the engineer of any train would discover that any part of the road was in *actual* danger of being washed away, or that any bridge was in danger of being destroyed by fire, or that a drove of cattle had broken through the fence, or anything that is sure to bring trouble, without notifying the proper persons to attend to the matter if any opportunity occurred for so doing. It is failing to notice matters that appear trifling that causes the mischief. A single spark of fire may ignite an old stump, which may burn slowly for days and weeks and appear perfectly harmless, when on the occasion of a high wind and dry weather miles of fences will be burned, together with wood piles, buildings and bridges and property of every description. This is no fancy picture, but is of frequent occurrence, and has on many occasions been attended with the loss of life. Although fire and water are useful, indeed indespensable, servants, they need watching. It is fatal to give them any liberty. "Give them an inch and they will take an ell."

It is often remarked, and with considerable truth, that "railroad men are a careless set." It is an old saying that "Corporations have no souls," and to this may be attributed the seeming recklessness or indifference manifested by railroad employes in the performances of their duties, or rather in the performance of anything outside the immediate line of duty. "For," say they, "the company pays us for doing a certain amount of "work, and if we do anything more, voluntarily, we get "nothing for it." They are not stimulated to any extra vigilance by the prospect of reward for any valuable service they may perform by way of being constantly alive to the interest of the company. The average railroad man considers that he has enough to do to keep his own neck out of danger while attending to his own prescribed duties, inasmuch as the company would not thank him for any extra exertions in their behalf, but instances are not wanting when they would have saved their own lives by a proper attention to matters which they deem of too trifling a nature to merit their attention.

Cost of Narrow-Gauge Railroads.

The following descriptions and accounts of cost of narrow-gauge railroads actually constructed have been given by Sir Charles Fox & Son, of London, engineers who have been engaged in the construction of such roads in Australia and India, and are published in the *Engineering and Mining Journal*. The estimates in each case include cost of stations, rolling stock, engineering and management, and the cost is in gold:

1. The Queensland railways, Australia. Length, 222 miles; gauge, 3 feet 6 inches. Wages: skilled laborer, $2.50 to $3.10; ordinary do., $1.50 to $1.75 Average cost per mile, $32,000.

2. The railway from Conyeveram to Arconnur, India. Length, 19 miles; gauge, 3 feet 6 inches. (Land and portion of road-bed given by government.) Materials chiefly sent out from England. Rails, 35½ pounds, iron. Average cost per mile, $19,000.

3. The Toronto, Grey & Bruce, and the the Toronto & Nipissing railways, Canada. Length of first section, 193 miles; gauge, 3 feet 6 inches. Wages: ordinary laborer, $1 to $1.50. Average cost per mile, $14,150.

4. The Government railways, Norway (constructed by Carl Pihl, C. E.) Length, 106 miles; gauge, 3 feet 6 inches. (Rails and many other materials sent out from England.) First, through easy country, $15,900 per mile; second, through heavy country, $23,700 to $26,150 per mile.

It will be seen that, the two first of these principles being conceded, it at once becomes possible to construct a thoroughly substantial track with rails not weighing more than from 30 to 40 pounds per linear yard, provided that the ties are laid sufficiently close, the rails well fished at the joints, and an ample supply of ballast provided.

The speed of twenty-five miles an hour is found in practice to be more than sufficient for tributary roads. A load of four tons per wheel is sufficient to enable the passenger and freight cars to be of ample dimensions for convenience of traffic.

The passenger cars of latest design are of the usual American type, thirty-two feet long, exclusive of platforms, and eight feet six inches wide, carrying very comfortably thirty-two passengers. Their center of gravity being very low, they run with great steadiness. The box cars are fifteen feet long and eight feet six inches wide. The platform cars are twenty-four feet long and eight feet six inches wide, and carry ten tons, their own weight being only five tons.

It will thus be seen that the non-paying load, or dead weight, is reduced from the usual proportion of one-half to one-third of the gross weight; and from this results an important saving in operating expenses.

The locomotives are generally of two types.

Type 1, or freight engine, has eleven-inch to twelve-inch cylinders; six coupled wheels, three feet three inches in diameter, and a four-wheeled bogie, and weighs about twenty tons, exclusive of tender.

Type 2, or passenger engine, has ten-inch to eleven-inch cylinders, four coupled wheels, three feet three inches in diameter, and a four-wheeled bogie, and weighs about sixteen tons, exclusive of tender.

The maximum grades vary from 100 to 132 feet to the mile. The sharpest curves are of from 500 to 330 feet radius. The grading has generally a width in cuts of fifteen feet, and on banks of twelve feet. The bridges are sometimes of iron, with masonry substructure, sometimes altogether of timber. The depots are of neat but economical design. The railroads are generally fenced throughout.

On the Canadian roads careful arrangements are made to protect the track from snow, and to provide in every detail against the effects of frost.

The cost of the Canadian roads, viz., about $14,000 per mile, may be taken to fairly represent the probable outlay (including every expense of right of way, management, etc.) for the building and equipping of a road of this gauge through an undulating and well-settled country, involving considerable expenses for right of way, say, 15,000 cubic yards of grading per mile, frequent road-crossings, fencing throughout, and a fair proportion of bridges, depots, side-tracks, and an ample equipment for a considerable traffic.

On the other hand, in the great prairie country of the West, where right of way, grading, and bridging are at the minimum, where 36 lb. rails would be ample, where fencing is not necessary, and where the provision for depots, side-tracks, and equipments could be materially reduced, a well constructed and substantial railroad of the 3 ft. 6 in. gauge may be completed *and equipped* ready for operating, with an expenditure not exceeding from $8,000 to $10,000 *per mile*, and on such a road, as both grades and curves would be easy, trains carrying a net load of 100 tons of freight could be operated with facility, at a speed of from 20 to 25 miles per hour.

The prices of labor in Australia, as given in the first example, are very nearly the same as the prices in the United States; the cost of iron there can hardly be as much as here, our heavy tariff probably more than making up the difference in the cost of transportation; yet the cost per mile, $32,000, would be sufficient for the construction and equipment of a 4 ft. 8½ in. line here, with 50 lb. rails. The Canadian examples cannot be so well compared with works here, as the cost of labor here is about 50 per cent. more, of iron, quite as much more, and of timber somewhat more.

ILLINOIS CENTRAL RAILROAD.

Report for the Year Ending December 31, 1870.

PRESIDENT'S REPORT.

The unusually light yield of corn in Illinois in 1869 gave rise to serious apprehensions as to the result of the company's operations during 1870; but the statements and reports herewith submitted exhibit a much more gratifying result than was anticipated.

During the year the lines in Iowa leased by this company were completed, and the number of miles now in operation is 402 15-100, being about 134 miles more than were in operation at the date of my last report.

The gross earnings of the whole line were $8,678,958.22; operation expenses, $4,759,007.81; State taxes, $490,111.56; and rent of leased lines in Iowa, $572,517.05—leaving net earnings $2,857,321.80, against $2,887,375.38, in 1869; a decrease of $30,053.58. The percentage of expenses to earnings, including State taxes, was 60 5-10 per cent., against 61¼ per cent. in 1869.

The gross earnings in Illinois were $7,211,552.81, and the net, $2,790,105.22, being an increase over last year of $57,349.06; and of leased lines the gross earnings were $1,467,405.41; working expenses, 802,144.74; State taxes, $25,527.04; and rent, $572,517.05—leaving a net profit of $67,216.58.

During the year 1,623,944 tons of freight of all classes were hauled, against 1,601,972 tons in 1869; the rates for which averaged 2 31-100 cents per ton per mile, against 2 48-100 cents in 1869.

The motive power and rolling stock of the company have been maintained in efficient order. In the maintenance and renewal of the track the expenditures amount to 1,257,290.79, and include the cost of re-rolling 7,146 6-10 tons of iron. In Illinois, 65 miles of track were relaid with re-rolled iron, and 84¼ miles with repaired and old iron; and in Iowa, 6 6-10 miles with re-rolled iron, and 20¾ miles with repaired iron.

Bridges have received thorough repairs, and of the amount charged to this account $28,171.78 was for replacing six spans of the bridge over the Illinois River with iron. This bridge (2,883 feet long) is, with the exception of the draw, entirely of iron, with substantial stone abutments and piers.

The amount of permanent expenditures was $414,309.95, of which $195,263.33 was for construction, and $214,288.11 for equipment. Included in the construction expenditures is the cost of ballasting, with stone, 21 9-10 miles of track—a portion of the cost of new spans in Illinois River bridge—of new and substantial engine house and workshops at Waterloo, and 2 1-10 miles of new siding. Of the total amount charged for construction, $28,803.30 was expended on leased lines. The equipment has been increased by the addition of ten locomotives, three sleeping cars, three mail and express cars, eight caboose cars, twenty-three house cars, two flat cars, and two snow plows.

Arrangements were perfected during the past year with the Belleville & Southern Illinois Railroad Company, by which we run through passenger and freight trains between St. Louis and Cairo; and we have also made satisfactory relations with the St. Louis & Southeastern Railroad Company. Our arrangement with the St. Louis, Vandalia & Terre Haute Railroad Company for a direct route between Chicago and St. Louis has proved to be of benefit to us. Negotiations are pending for the construction of a road between Cairo and the Mobile & Ohio Railroad, but no definite arrangement has as yet been made. The completion of the Iowa Falls & Sioux City Railroad to Sioux City enables us to compete for the trade of Dakota and the territories of the Northwest. The country west of Fort Dodge is unsettled, and, until the lands adjacent to that line are disposed of and improved, the traffic will be light.

The Land Department during the past year collected $2,111,865.84 and sold 60,858 22-100 acres of land for $625,991.90, at an average of $10.28 per acre. The total expenses of the department were $104,058.56. The lands sold averaged 54 acres to each purchaser. The amount owing to the department at the close of the year for lands sold, was $2,989,024.40. During the past year 4,120 deeds were issued, embracing 264,872 93-100 acres, which canceled $2,018,536 of construction bonds. The total amount of canceled bonds used to the close of the year by the issue of deeds was $12,163,263. Of the original grant of land (2,595,000 acres) there had been sold at the close of the year 2,179,390 acres, of which 1,621,703 44-100 acres had been deeded and are now subject to taxation. There are 415,610 acres remaining unsold, of which 256,847 53-100 acres are located south of the Ohio & Mississippi Railroad, and being heavily timbered and not so easily brought under cultivation as the open prairie lands, they have been, and are, slow of sale.

The total amount paid during the year for interest on funded debt, sterling exchange and premium on gold used to pay coupons in New York, was $622,053.28. For dividends and United States taxes thereon, $2,594,391.59. We closed the year with a balance of $1,840,090.55 in net assets; a stock of working supplies costing $749,665.56; a fund of $1,552,500 for the purchase of construction bonds; and with $1,414,738 bonds in hands of trustees in advance of deeds and collections.

The funded debt was reduced during the year by the purchase of $97,500 of 7 per cent. construction bonds, and now amounts to $6,869,500, after deducting the amount set aside for the purchase of construction bonds.

The annual meeting of the shareholders will be held in Chicago on Wednesday, the 31st of May next. The term of service of three directors will expire at that date.

JOHN M. DOUGLAS, President.

CHICAGO, March 13, 1871.

REPORT OF THE GENERAL SUPERINTENDENT.

Of this report, which is signed by A. Mitchell, Assistant General Superintendent, and dated March 7, we give a short summary, hoping to add to it next week:

The earnings during the year were $8,746,776.90 from the following sources:

COMPARATIVE STATEMENT OF EARNINGS FOR THE YEARS 1869 AND 1870.

	1870.	1869.	Increase in 1870.	Decrease in 1870.
Freight*	$6,142,520 62	$6,309,867 30	.....	$167,346 68
Passengers	2,117,527 41	2,102,990 27	$14,537 14	.....
Extra Baggage	4,014 71	3,342 93	671 78	.....
Sleeping cars	31,674 00	24,547 00	7,127 00	.....
Mails	97,672 25	86,885 72	10,786 53	12,889 48
Express	189,125 60	202,015 08	.....	.....
Rent of property	136,545 75	117,873 99	18,671 76	4,915 25
Dockage	8,511 00	13,426 25	.....	4,186 07
Rent of cars	19,185 56	23,371 63	.....	.....
	$8,746,776 90	$8,884,320 17	.....	$137,543 27

* Earnings over other roads, $556,732.57. This is the gross amount of earnings over other roads, exclusive of leased lines.

Showing a decrease of $137,543.27 from the earnings of 1869.

COMPARATIVE STATEMENT OF OPERATION EXPENSES FOR THE YEARS 1869 AND 1870.

	1870.	1869.	Increase in 1870.	Decrease in 1870.
Salaries	$188,946 28	$175,620 29	$13,325 99	.....
General expenses	261,572 33	257,959 93	3,612 40	.....
Claims and damages	84,998 32	68,501 88	16,496 44	.....
Station expenses	662,471 79	696,587 00	.....	$34,115 21
Train expenses	1,009,431 30	992,749 64	16,681 66	.....
Maintenance of machinery	1,150,589 16	1,246,478 21	.....	95,889 05
Maintenance of way	1,257,290 79	1,314,029 86	.....	56,738 07
Repairs of fencing	69,236 31	107,062 26	.....	37,835 95
Operating St. Charles Air Line	4,589 79	7,567 12	.....	2,977 33
Legal expenses	26,112 07	17,365 22	8,746 86	.....
Insurance	33,779 67	40,673 79	.....	6,894 12
	$4,759,007 81	$4,924,594 20	.....	$165,586 39

Showing a decrease of $165,586.39 from the expenses of 1869, and the operation expenses of an average of 1,008½ miles of road for the year.

The proportion of operation expenses, exclusive of charter tax, to earnings is 54 41-100 per cent.

—The earnings of the Union Pacific Railroad in February, 1871, were $305,769, and the expenses, $168,772.95—leaving the net earnings $137,596.05. In February, 1870, the earnings were $500,139.42, the expenses, $449,838.67, and the net earnings, $50,300.75—showing a decrease in earnings of $194,370.42, with a decrease in expenses of $281,665.72—making the increase in net earnings, $87,295.30.

—The Dayton Short Line Railroad has contracted for grounds for a freight depot and other buildings in the vicinity of the Cincinnati, Hamilton & Dayton Railroad Depot, conditioned upon the building of the road.

About Railroad Men.

The recent terrible catastrophe at New Hamburg has called public attention to this class in a manner which suggests a brief allusion to its various elements. When any one enters this branch of service he will soon find that he is a member of a very interesting community—one having its opinions, its rules, and its customs peculiar to itself. Even the water-boy may feel his pre-eminence over other youth, and so can the book-boy, or news agent, who in good times can make his $10 or even $15 per week. Then there is the brakeman, of whom there is one to every pair of coaches, or, in other words, half a man to each coach. To him there is no music like the steam whistle—at one time the long and distressing shriek blowing for a station, and then the short puff or signal for breaking. This brings him to his lever, and with a wrench that throws his body into all manner of contortions he fetches the roaring train to a halt. These fellows have all the dignity of a craft. They are known as "Jack," or "Bill," or "Charley," and when passing at full speed they will greet each other on different trains, by a gesture peculiar to themselves, being a gentle motion of the hand like one beating time. The brakemen formerly received only $25 per month, but of late years their pay has been raised to $40. This they increased by running on extra trains, by means of which they often made $60. A good brakeman may hope in time for promotion, and if not here he may go West, where they often are put into important positions. The risks of this employment are very considerable, but notwithstanding this there is always a rush for every vacancy. The great misfortune of this class is its temptation to dissipation. Brakemen could save money if they chose, and indeed I knew one young man in the employ of the Central a few years ago who, by strict economy, laid the foundation of a handsome property.

THE CONDUCTOR.

The importance of this officer is not to be expressed by mere words. On the daily twenty trains which traverse the Hudson River & Central each conductor holds a trust of life and death importance. He is, like the captain of a ship, the supreme commander of his train, and from the time he takes charge of it, either at Buffalo or Syracuse, or at Troy, or New York, his word is law until he brings it to its destination. During this time he is required to maintain incessant vigilance, and at every station he can be notified by telegraph of any change or dangers on the line. He is held responsible to a certain degree for all accidents, and must on such occasions vindicate himself or lose his place. To illustrate, I may state that a train was delayed by various detentions, and before reaching Albany a slight accident occurred. It was said that the conductor had fallen asleep, and on that charge he was dismissed. Another illustration is that of the conductor of a train, bound from Syracuse to Albany, who was desirous of making a speedy trip to Troy, and consequently left the train at Schenectady in charge of the baggageman and took the Troy express. This took place at four o'clock in the morning, when it might escape notice, but it was discovered by the Superintendent, and dismissal followed. Freight conductors *are* allowed to sleep, because their duties are more tedious, but they are held responsible for many casualties. Some time ago an expensive carriage was sent on a platform car to its destination, but a severe gale of wind blew it off, and as this took place at night, it was not noticed until a long time after it occurred. This was also the ground of a dismissal. The conductors of passenger trains are the means by which the company comes in contact with the traveling public. On this account each one is expected to exhibit good dress and polite manners, and this he must maintain under all circumstances. His position would be a pleasant one were it not for the frequent attempts at imposition to which he is subjected. One class of imposters are those who beg their passage, or who attempt in any other way to evade payment—a class much more abundant than the reader may suppose. A conductor allows no one to ride free unless he has a pass regularly issued by some authorized officer of the road, the violation of this rule being a just ground for dismissal. It is often very unpleasant to put a man off, but it is inevitable, and that is the conclusion of the matter. However, there is a very great difference in the manners of railway conductors, some of whom are repulsive, while others are courteous and kind-hearted.

LAWS OF RAILROAD LIFE.

I have referred to these, and may again speak of them as rigid in the extreme. Such is the grade of subordination from the President, General Superintendent, Division Superintendent, Station Agents, etc., that all orders must be obeyed without question. There is but one law for all, and that is obedience; and there is one penalty, discharge. The railroad man is therefore under a daily risk of losing his berth, and what in others might be a trifling neglect becomes in his case unpardonable, since it may cost human life. It is a rule, closely adhered to, that no man shall commit a blunder a second time, or in other words the opportunity will not be permitted him. This rule admits of no amelioration, and hence, while no man is discharged *without cause*, yet the oldest man on the road may be removed at any time *with cause*, and without hope of restoration. This rule, like the sword of Damocles, is always over-hanging them.

AFFINITIES AND FRIENDSHIPS.

There are very strong ties uniting this class, and they have a peculiar *esprit du corps*, which shows itself on all suitable occasions. Whenever business slackens so that a smaller number of men can perform the daily service, instead of waiting to be discharged they mutually abate their time, add sometimes each man will lay off for a week. A general loss is submitted to rather than to have its whole weight inflicted on one of the fraternity. Whenever one of their number dies a badge of mourning is worn by the whole as a token of

respect for at least thirty days. The same spirit is also exhibited by many kind offices shown each other, and this feeling is very much to their credit.

RAILROAD BENEFIT SOCIETY.

The Central & Hudson River consolidated roads have a very useful society of a mutual character, whose title is given above. The terms of union are $2 entrance fee, and then an assessment of $1 on the death of any member, for the benefit of his family. When Major Priest's brother, who was freight agent at Little Falls, died, his widow received $580 from this society. "Doc." Simmons was also a member, and, as the union has increased, his widow will receive about $800. It has been a matter of surprise that Simmons did not jump from his engine. To this it may be replied that a first-class locomotive is of such strength as to dash to pieces many powerful obstacles, and in several instances engineers have knocked off and over-rode impediments which they did not discover in time to stop. Simmons was a man of great nerve, and thought, perhaps, that he might dash through in safety. In addition to this, it must be remembered that to leap from an express train under full speed is exceedingly dangerous, especially by night. Hence it is a wonder how the fireman escaped. Railway men generally agree that it is unsafe to leap from a train whose speed exceeds fifteen miles per hour, but when danger threatens they must take their chance. In that case the leap should be forward, starting from the lowest step, and should be made so as to strike on the heels.

RAILWAY CREWS.

A railway train has a fixed crew (as it is called) the conductor being the captain. Add to this an engineer, a fireman and two brakemen, and the number is complete, unless you have an extraordinary long train. There are eighty-five crews in the freight business on the Central, and about ninety in the passenger business. Having referred to the rates of pay enjoyed by these men, I would add that each can increase his earnings one-third by running "extras," as it is termed. That is to say, the regular stint affords them sufficient time for overwork. This is a source of much encouragement to railroad boys, and without it there would be little inducement to incur the incessant danger which attends this mode of life.

RATES OF PAY.

Conductors of passenger trains receive $90, while freight conductors are paid but $65 per month. Engineers earn $100 and firemen $65. Baggagemen's wages are $60, and brakemen we have referred to. Station agents receive from $50 to $100, and ticket receivers are about the same figure, although the latter, in some instances add to this the earnings of a telegraph operator. Among the oldest, in point of service, in the Central, are E. S. Foster, of Albany, and Major Priest, Assistant Superintendent of the Eastern Division. The Major has worked his way up from the lowest rank, and has learned almost every duty up to his present station. He may be considered one of the leading men of Little Falls, where he lives, and he has been for several years Superintendent of the Baptist Sabbath School in that place. Another of the oldest employes on the road is G. T. B. Fonda, station agent at Fonda depot, a position which he has held since the road was opened.

Railroad men are a class that live by the rules laid down. They take the time-bill and the printed instructions as their daily chart. The impositions practiced on them by rogues oblige them at times to appear rough and stern, but all who show the signs of good breeding will be treated respectfully. They are trained by their method of life to look duty sternly in the face, and it is no small honor in such a class to have produced such a man as "Doc" Simmons, of the Pacific express, the hero of New Hamburg. It was a concentration in one man of "the charge of the six hundred," and the act was worthy of a muse equal to that of Tennyson.—*New York Globe.*

Planting Forest Trees on the Prairies.

BY H. W. S. CLEVELAND.

[Continued from Page 582.]

It is sufficient for the purpose to which I propose to devote the remainder of this article, to state that all intelligent persons east and west, whose studies or occupations have been such as to give weight to their decisions, are unanimous in their conviction that the demand is increasing in a far more rapid ratio than the supply; and, without referring to the important questions of the effect of forests upon climate and health, there can be no question that the planting of extensive tracts expressly for the furnishing of future supplies of timber, is a measure so urgently demanded, that its neglect can only be accounted for by the fact that "what is everybody's business is nobody's."

Setting aside, however, the considerations of the future wants of the older and more thickly settled portions of the country, it is obvious that the settlement and civilization of the great prairies lying between the Missouri and the Rocky Mountains is literally impossible without providing timber to meet the wants of settlers. Railroads may be constructed, as the Pacific Railway has been, by the constant efforts of construction trains in bringing forward supplies from the rear. But even if the forests from which these supplies are drawn would suffice for the wants of so large a region, the cost of transportation of timber for houses, barns, and buildings of every kind, together with fences, wagons, tools, and implements, to say nothing of fuel, would be such as would prevent the possibility of settlement, except in localities where an investment of capital was warranted by special objects. The class of pioneers who are usually the first to develop the agricultural wealth of a new country, and whose labor and production are the foundation on which its prosperity must rest, could gain no foot-hold in a region, which, whatever might be the capacity of its soil, is destitute of the timber which is essential to its settlement and cultivation.

Until this want is supplied, therefore, the region in question must form a natural barrier, or line of separation between the eastern and western portions of the country, rather than a connecting link, whose wants and resources would contribute to the wealth and active commercial intercourse of each. How much of the region is capable of growing timber at all, how much of it requires irrigation to secure the growth of any species of vegetation, and how much consists of alkaline deposits, on which no culture is possible, are questions of vital interest to the country, but to which only vague and indefinite replies can yet be made. But of this simple fact we may be assured, that extensive tracts, which are capable of forest culture, and which in their present condition may be said to possess no intrinsic value, are now accessible by the Pacific railroads. We know that the belt of prairie has its greatest transverse expansion in the Missouri Basin, and that east of the meridian of Fort Laramie the prairies are covered with rich grass adapted to pasturage. West of that meridian the ground is sandy and sterile, and everywhere covered with the artemesia, growing alike on the hills and in the river bottoms, in tough, twisted, wiry clumps. These general characteristics are gained from the unanimous reports of all who have explored the country.

At present, the point of vital interest, ascertained in the exploration of this region, lies in the fact that the country lying between the Missouri and the meridian of Fort Laramie is mostly prairie, and "covered with rich grasses adapted to pasturage." Where such grasses will grow, trees will grow. The first step toward the settlement of the country should, therefore, be the planting of great tracts of forest, wherever it is practicable, along the line of the railroad or elsewhere; and the first thing to be ascertained is, what varieties of trees are best adapted to such culture. Probably it would be impossible for some of the varieties most desirable for timber, to live and thrive under the conditions to which they would be exposed; but, if we cannot have what we would, let us have what we can. Plant those which *will* grow, and in time they will serve as screens for more valuable kinds, as is done on the seashore, where the worthless abele (silver poplar) will grow luxuriantly, and in a few years form a screen, behind which more delicate deciduous and evergreen trees will thrive as readily as if they were unaware of their vicinity to the ocean.

In the absence of direct experiment upon the tract in question, I venture to offer some suggestions based upon an experience of twenty-five years, in which I have been more or less engaged in tree culture on the Atlantic coast, from Maine to Delaware, combined with a careful observation of the experiments of nurserymen and arboriculturists in Illinois and Iowa.

It is, of course, desirable to secure as great a variety as possible of the trees whose timber will be of the greatest value in the various uses to which it must be applied; but we know that it would be hopeless to attempt the culture of some varieties on the open prairie, until a shelter was provided to screne them from the rude blasts to which they would necessarily be exposed. Thus, the chestnut, which, on account of its rapid growth and the many valuable quantities of its timber, would be very desirable, would not be likely to thrive under such exposure; and the same may be said of the walnut and butternut. The locust, notwithstanding the great value of its timber, is everywhere so liable to the attacks of the borer, that it is not safe to plant it. The white ash and white willow are perhaps the most promising of the ordinary deciduous timber trees, and should be among the first on the list for trial. What is wanted, is a tree which will not only live, but thrive and grow rapidly, and, if possible, one whose timber may be used for a great variety of purposes; and while it is on all accounts desirable to plant as great a variety as possible, it will be the part of wisdom to make the first and most extensive plantation of the trees which best fulfill those conditions, and to this end I venture to recommend the European larch as combining in itself more of the essential qualities I have named than any other tree.

As many persons, even among those who are generally familiar with trees, are not aware of the great value of the larch as a timber tree, I am induced to give a somewhat detailed account of it, even at the risk of stating facts which may be familiar to some of my readers.

The Scotch or European larch is very much more rapid in its growth than the American, attains a larger size, and is a far more beautiful tree, being symmetrical in form, and thick and luxuriant in foliage; while the American, is ungainly in its growth, and its long, straggling limbs are but slightly concealed by its scanty foliage.

For plantations, therefore, whether for ornament or for timber, the European is so far preferable to the American, that I will confine my remarks to that variety.

Its native country is Switzerland, whence it has spread throughout all Europe, its valuable qualities being well known. It is considered the best of wood for the carpenter and joiner, being exceedingly compact, and taking a fine polish, easily seasoned, free from liability to crack or shrink, and the most durable in all kinds of exposure of any wood that is known. A French writer says of it: "Every one who knows the larch, agrees that it is the best of all the different kinds of wood, whether for the carpenter or the cabinet maker. The Germans make casks of it, which may be said to last forever, and from which the spirituous particles of the wine are hardly ever found to have evaporated. In Switzerland it is so highly prized as to be worth double the price of oak. No wood remains so long uninjured by water, for which reason it is extensively used for water-butts and pipes." Desfontaine, in his "Histoire des Aubres," confirms the accounts of its durability, and says that vine props made of larch are never taken up, but remain for an indefinite succession of years; and, in most cases, the proprietors of vineyards are entirely ignorant of the time when these props were planted in the ground. They received them in the same state from their fathers, and in the same state they transmit them to their sons."

"In traversing the forests of the Alps," says M. Boisel, "I found frequent proofs of the durability of the larch. Many had been shattered by lightning and storms; and I found a great number of mutilated and dead trees, but they had not perished. The wood, even of those which had long been dead, showed no signs of decay. I gathered branches, and split open trunks of these dead trees, but could find no instance of rottenness."

Malesherbes mentions, in 1788, that he examined some houses in the South of France which had been built of larch timber 240 years before, and found the beams not only perfectly sound, but so hard that he could not penetrate them with a knife.

[Concluded next week.]

New Drawing-Room Cars on the Erie Railroad.

A New York paper gives the following description of the "Jay Gould," a new coach on the Erie Railway. Three others similar, "James Fisk, Jr.," "Morning Star," and "Evening Star," are completed, and three are in the shops:

"The Jay Gould is 56 feet by 11 feet; will seat fifty-six passengers; is lighted by Ganster's gas machine, heated with Baker, Smith & Co.'s patent car steam-heating apparatus, with pipes under each seat and sofa; has two water-closets, two wash-rooms in white marble, black walnut, maple, rosewood and gilt; a ladies' laboratory; ice-water tanks and attachments; five reflecting gasaliers suspended from the ceiling, trimmed with silver, by Geo. H. Keitching & Co. The interior of the car is trimmed with silver, wherever metal is used, including arms, hinges, rails, knobs, hat-racks, clothes-hooks, brackets, window fastenings, door-slides, etc., by Newman & Capron, of New York.

"The bridal chamber has velvet Brussels carpet; the furniture is covered with drab medalions of crimson scarlet, white and rose colors; drab silk curtains, intermixed with blue and gold, bought of Stewart; sofa beds with easy pillows and bolsters, chairs on revolutionary hinges; beds with improved spiral steel spring mattresses, covered with crimson reps; beds raised by automatic or spiral springs, so complete that a child can raise or lower them. The ceilings were frescoed by Sebastian Brodt.

"The car is trimmed with French moquette, and green, drab, and gold crimson are the prevailing colors. The windows are of best French plate glass—one large or center one and two smaller or movable ones—the whole of etched glass by Downing, and in all the panels is the Goddess of Music, with a lyre etched in the glass. The wood used is black walnut, ash-bars, black walnut panels and rosewood mouldings, inlaid with gold, the two former coming from the West. There is a mirror in each door and panel. The seats are peculiarly adapted for ease and comfort, being upholstered at the ends, back, and extra or louging back with French moquette of green, drab, crimson and gold. The cushions are on the best of steel spiral springs and are adjustable; arms silvered. The upper berths are self-acting. The busts of Mr. Gould, inside, are carved of white holly, the Erie Company doing all the carving of the car at a cost of $4,000 each. The portraits in oil of Mr. Gould on each side of the outside of the car will attract much attention. The oil paintings in the inside or frescoed panels are representations of scenery along the line of the Erie Railway. Chairs are hung with silver slipjoint hinges. The ventilation is very complete and is formed by wire screens in the roof over each platform, and from this point is conducted through the car, being increased or lessened by the use of beautiful glass-paneled swivel ventilators in the roof of the car. The wire screens prevent cinders from going in. The electric or magnetic brake is used; Miller's platform buffer and bumper; six-wheel trucks with steel tires on wheels, the steel and iron being cast solid together; eight guard chains from trucks to car body, and elliptic and rubber springs combined. The several departments of the company's workshops are so complete that these cars in all their elegance are made therein, embracing cabinet work, upholstering, painting, gilding, body trucks, etc. The Jay Gould weighs but twenty-five and one-half tons on a wide track, whereas a Pullman narrow-gauge car weighs twenty-eight to thirty tons. Commerce, railroad and shipping are represented on the outside corners of the car. None but the best selected timber was used. Mr. Gould gives a personal supervision over the workshops and employes in the construction of these and other cars. The style and finish of the Col. James Fisk, Jr., is very similar to the Jay Gould, except that the Colonel is represented on the outside corners by four members of his staff. The cost of each car is about $35,000."

Railroad Finance in Canada.

When the first railway charters were granted in Canada, there seems to have been a notion that the companies would be likely to make too much profit, and that their earnings, over and above a fixed dividend, formed a fair subject of taxation. More than one charter provided that a moiety of the net earnings, over a dividend of ten per cent., which should have been paid ever since the work of construction commenced, should go into the public exchequer. In other cases the tariff was to be regulated by the amount of yearly dividend. It is not necessary to say that these clauses never became operative. The following embrace the various phases of railway finance which have been resorted to in Canada:

1. Authority given to government to issue debentures by way of loan to railway companies. This authority was given long before any company was in a position to avail itself of the offer.

2. Authority to grant a like loan with a provision

that if the company did not pay the interest on the government debentures the property of the cities and townships benefitted should be assessed for the same.

3. Government guarantee of the interest on railway companies' bonds.

4. Government guarantee of railway company's bonds, as well as the interest thereon.

5. Direct issue of government bonds to railway companies with a first mortgage on the property of the companies as security.

6. Government guarantee of share capital; asked, but not granted.

7. Municipal loans to railway companies.

8. Municipal subscription to railway stock.

9. Municipal bonuses to railway companies.

10. Government bonuses to railway companies.

11. Raising capital by lottery; authorized but not carried out.

12. Imperial government guarantee of capital with which to construct the Intercolonial Railway.

13. Share capital, locally contributed, and issue of bonds.

14. Share capital, chiefly English, combined with government aid, in some of the forms above mentioned, and issue of various degrees of bonds under different names.

15. Aid in the shape of lands through which the road would run; projected, but never carried into effect.

16. Practical release of government guarantee, by placing it hopelessly behind other claims, after railway companies became embarrassed.

17. Composition of government claim accepted, when railway companies became embarrassed.

18. Assumption of liabilities incurrred by municipalities in aid of railroads, by the government, the government becoming the creditor of the municipalities.

19. Direct construction of railways by government.

It required much unpleasant and even disastrous experience to prove which of these various modes of raising money were safe or advisable, and which were the reverse. A very large proportion of the share capital of the different railway companies has been unproductive—the Great Western is about the only exception—much of it may be set down as valueless, for there is no prospect that anything will ever be realized from it. The municipal loans are all, or nearly all, lost—lost in the sense which a loan implied, and which contemplated repayment. Still it does not follow that value for the outlay has not been obtained in the facilities of railway service. The greater part of the government loans have shared the same fate. In their case, also, the return received by the country, though ample, has been indirect. The Legislature acted on the assumption that they would be repaid, long after all prospect of such a result had vanished. Experience has taught this lesson: that if government grants aid to a railway company it may make up its mind that it will from that day have a bad debt in its books. The Ontario Government has profited by this experience, and resolved to put its aid to railways in the shape of a bonus. When we take this course we know what we are doing—no false expectations are raised, and no gap is made in the public finances by a disappointment in repayment. The accumulation of a large surplus enables the government to assist these undertakings with ease. This saving of three millions and a half in four years is one of the most extraordinary achievements in the history of government finance, considering the small annual revenue out of which it is saved, and it presents the greatest contrast to the condition of things when Upper Canada closed the first period of her Provincial existence, in 1841. She was then paying the interest on the public debt, which was nearly equal to six-sevenths of the entire revenue, out of borrowed money, and accumulating a deficiency of $200 000 a year. Now we save the thick end of a million every twelve months.—*Canadian Monetary Times.*

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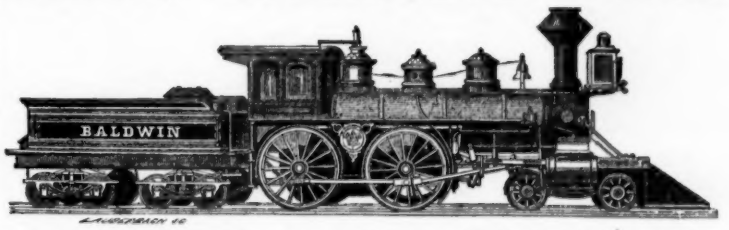

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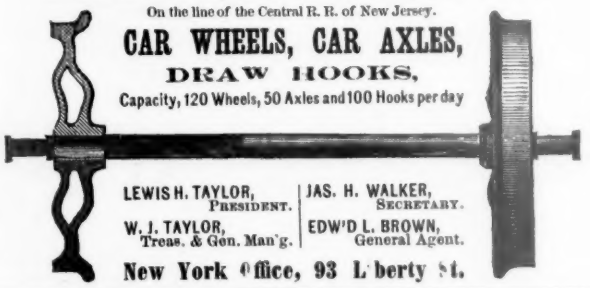

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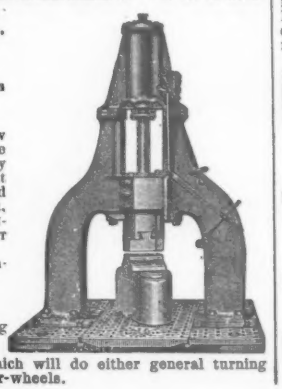

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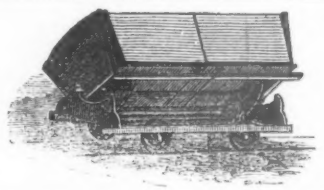

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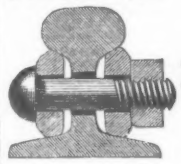

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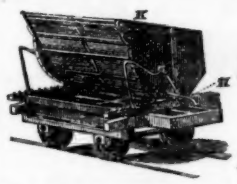

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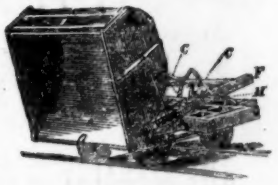

Fig 1.—Car Loaded and at Rest. *Fig. 2.—Car Dumped.*

TO DUMP THE CAR.—The Brakeman seizes the lever, H, and raises it about a foot, thus releasing the hopper from the catch, C, and the tilting-frame, F, from the catch, C, when the hopper, K, yields with the force of gravity and rolls over to the position shown in Fig. 2

To Replace the Hopper in Readiness for Another Load.—The brakeman bears his weight on the up-end of the tilting-frame, F, forcing it down to its place, when the hopper rolls back to its place, where it is held by the catches, C and C.

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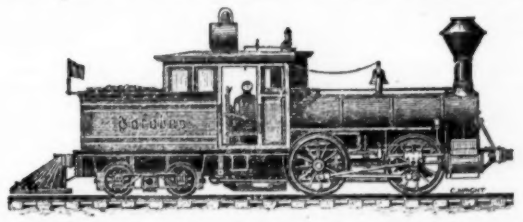

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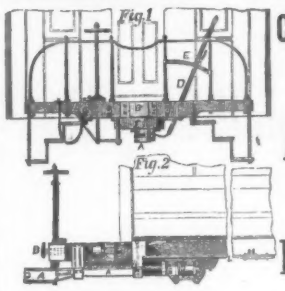

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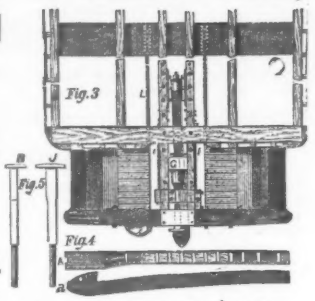

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6th. The platforms may be held as close together as desired.
7th. By close coupling the train is shortened.
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11th. They cause the train to move steadily and not jerk in starting or stopping.
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13th. They will couple with all kinds of "drawheads" and "couplers."
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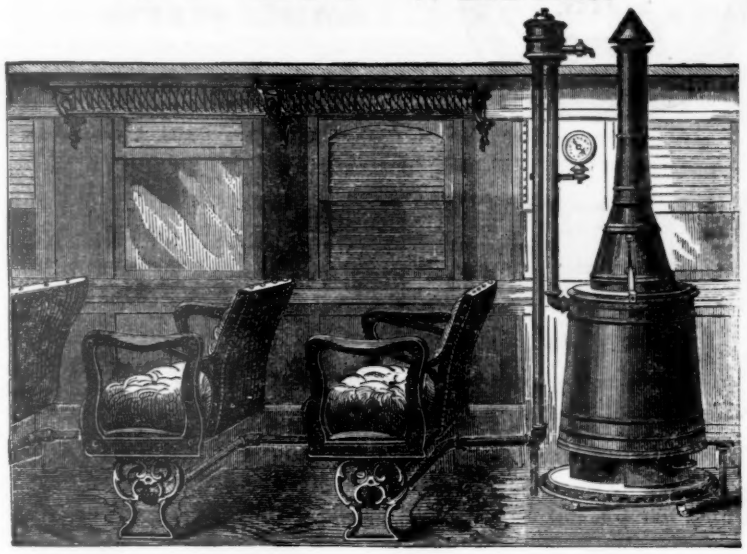

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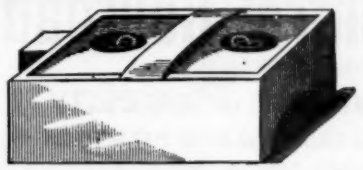

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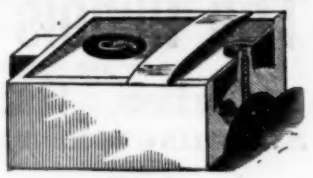

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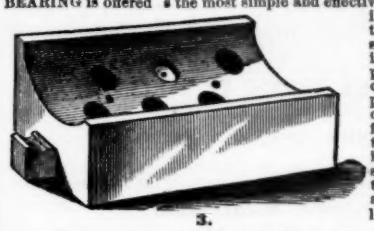

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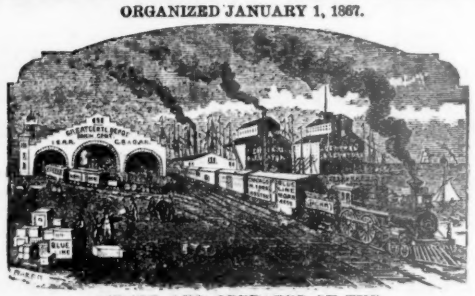
1871.  1871.

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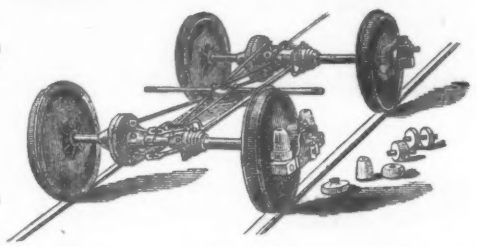

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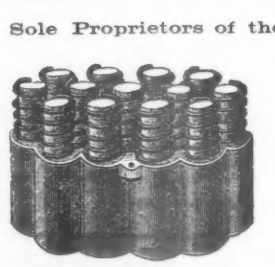

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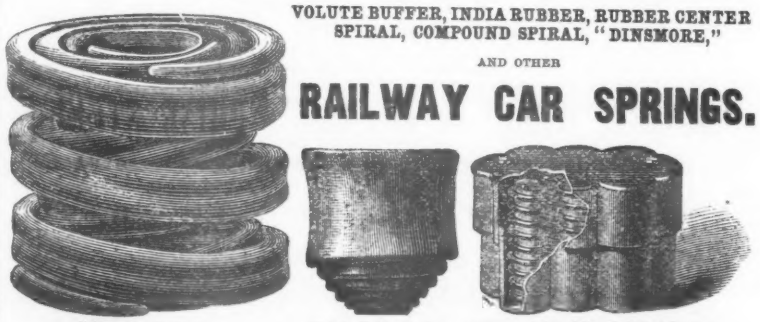

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No. 1 Barclay St., NEW YORK. | **No. 15 La Salle St., CHICAGO.**

WORKS ON **129th** AND **130th** STREETS, NEW YORK.

GEO. WESTINGHOUSE, Jr., Pres. ROBERT PITCAIRN, Treas. RALPH BAGALEY, Secretary

Westinghouse Air Brake Company

OF PITTSBURGH. Incorporated by the State of Pennsylvania, 1869.

MANUFACTURERS OF

THE WESTINGHOUSE AIR BRAKE!

A simple, cheap and effective invention, whereby the entire control of a train of cars is placed in the hands of the Engineer. It is in daily use on a number of the leading Railroads, and is recommended by the most prominent railroad mechanics in the country as an actual necessity.

A Trial Train furnished to any Railroad Company, to be paid for only when found satisfactory. Full information furnished on application.

General Freight and Ticket Department.

Leavenworth, Lawrence & Galveston
RAILROAD LINE.

IN CONNECTION AT KANSAS CITY WITH THE

Chicago, Burlington & Quincy R. R., Hannibal & St. Joseph R. R., North Missouri R. R. and the Pacific R. R. of Missouri,

— FORMS THE —

SHORTEST, QUICKEST & MOST RELIABLE LINE

For FREIGHT and PASSENGERS from the EAST,

Via CHICAGO and ST. LOUIS, to

SOUTHERN KANSAS, THE INDIAN TERRITORY

— AND —

TEXAS!

THROUGH BILLS OF LADING given by any of above-named roads, to points ON OR SOUTH OF THEIR LINE, and such Contracts protected by this Department.

TRUNK LINE CLASSIFICATION ACCEPTED. FREIGHT FROM THE EAST THROUGH TO THE INDIAN COUNTRY WITHOUT CHANGE OF CARS.

THROUGH TICKETS For sale at all principal points East to the different places in Kansas, via this line.

PULLMAN'S SLEEPING CARS ON ALL THROUGH TRAINS!

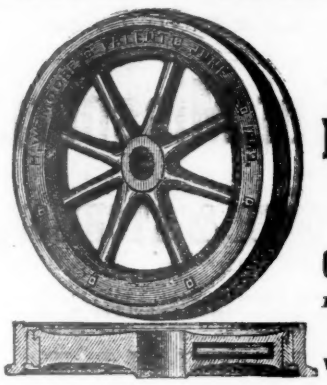
☞ Full information as to rates and time, either Freight or Passenger, furnished by General Freight Agents of above-named roads.

☞ **Special Rates** given to Colonies. For full information as to rates, time, or description of country, apply to the undersigned.

M. R. BALDWIN, Superintendent, Lawrence, Kansas.

CHAS. B. PECK, Gen. Freight and Ticket Agent, Lawrence, Kan.

MOORE
Steel Elastic Car Wheel Co.
OF NEW JERSEY.



Proprietors of

MOORE'S PATENT

FOR THE MANUFACTURE OF

ELASTIC CAR WHEELS,

FOR PASSENGER AND SLEEPING COACHES.

Noiseless, Safe, Durable and Economical.

Also, Manufacturers of

CAR WHEELS OF EVERY DESCRIPTION.

H. W. MOORE, President.
JAS. K. FROTHINGHAM, Secretary.
F. W. BLOODGOOD, Treasurer.

Works, cor. Green and Wayne Sts., JERSEY CITY, N. J

P. O. Address—Box 129, Jersey City, N. J.

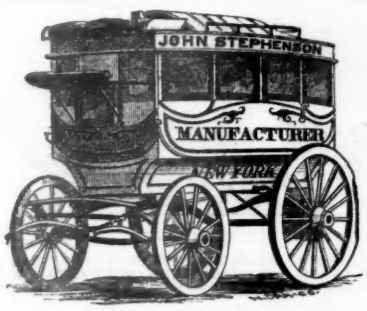
American Compound Telegraph Wire.

More than 3000 Miles now in Operation,

Demonstrating beyond question its superior working capacity, and great ability to withstand the elements. For RAILROAD LINES, connecting a single wire with a large number of Stations, and for long circuits, this wire is peculiarly adapted; the large conducting capacity secured by the copper, with other advantages, rendering such lines fully serviceable during the heaviest rains.

Having a core of steel, a small number of poles only are required, as compared with iron wire construction, thereby preventing much loss of the current from escape and very materially reducing cost of maintenance. OFFICE AMERICAN COMPOUND TELEGRAPH WIRE CO.
234 West 29th Street, New York.

BLISS, TILLOTSON & CO., Western Agents,
247 South Water Street, Chicago.



OMNIBUSES

—OF—

EVERY STYLE!

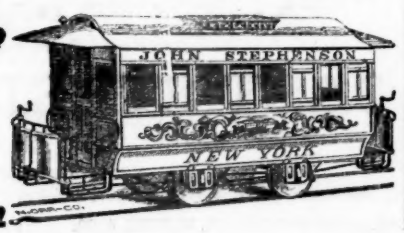
☞ Orders Promptly Filled. ☜

CARS,

LIGHT, STRONG

—AND—

ELEGANT!



CHICAGO, ROCK ISLAND & PACIFIC
RAILROAD.

☞ THE DIRECT ROUTE FOR ☜

JOLIET, MORRIS, OTTAWA, LASALLE, PERU, HENRY, PEORIA,

Lacon, Geneseo, Moline,

ROCK ISLAND, DAVENPORT,

Muscatine, Washington, Iowa City,

GRINNELL, NEWTON, DES MOINES,

COUNCIL BLUFFS & OMAHA!

CONNECTING WITH TRAINS ON THE UNION PACIFIC RAILROAD, FOR

Cheyenne, Denver, Central City, Ogden, Salt Lake, White Pine, Helena, Sacramento, San Francisco,

And Points in Upper and Lower California; and with Ocean Steamers at San Francisco, for all Points in **China, Japan, Sandwich Islands, Oregon and Alaska.**

☞ TRAINS LEAVE their Splendid new Depot, on VanBuren Street, Chicago, as follows:

	LEAVE.	ARRIVE.
PACIFIC EXPRESS, (Sunday excepted)..	10.00 a. m.	4.15 p. m.
PERU ACCOMMODATION, (Sundays excepted).....	4.30 p. m.	9.45 a. m.
PACIFIC EXPRESS, (Saturdays excepted,).....	10.00 p. m.	[Mon. ex. 7.00 a. m.

ELEGANT PALACE SLEEPING COACHES!

Run Through to Peoria and Council Bluffs, Without Change.

☞ Connections at LA SALLE, with Illinois Central Railroad, North and South; at PEORIA, with Peoria, Pekin & Jacksonville Railroad, for Pekin, Virginia, &c.; at PORT BYRON JUNCTION, for Hampton, LeClaire, and Port Byron; at ROCK ISLAND, with Packets North and South on the Mississippi River.

☞ **For Through Tickets,** and all desired information in regard to Rates, Routes, etc., call at the Company's Offices, No. 37 South Clark Street, Chicago, or 257 Broadway, New York.

A. M. SMITH, Gen. Pass. Agent. HUGH RIDDLE, Gen. Supt. P. A. HALL, Asst. Gen. Supt.

KANSAS PACIFIC RAILWAY.

Great Smoky Hill Route

THROUGH KANSAS TO DENVER, COLORADO,

Connecting with the DENVER PACIFIC R. R. for CHEYENNE; forming, in connection with the UNION and CENTRAL PACIFIC R. R.'s, a NEW ALL-RAIL ROUTE to

Colorado, Wyoming, Utah, Montana,

NEVADA, CALIFORNIA,

AND THE PACIFIC COAST.

THE ONLY ROUTE RUNNING PULLMAN DRAWING-ROOM & SLEEPING CARS THROUGH TO DENVER.

☞ **No Omnibus or Ferry Transfer!** ☜

☞ Direct Connections made in UNION DEPOTS at **Kansas City** [State Line,] with the Hannibal & St. Joseph, North Missouri and Missouri Pacific Railroads.

☞ Daily Trains leave Kansas City, State Line and Leavenworth, for Lawrence, Topeka, Emporia Humboldt, New Chicago, Chetopa, Junction City, Abilene, Salina, Brookville, Ellsworth, Hays, KIT CARSON, DENVER, GREELEY, CHEYENNE, OGDEN, SALT LAKE CITY, CORINNE,

Sacramento & San Francisco.

☞ Connect at Kit Carson with Southern Overland Passenger and Mail Coaches for PUEBLO, TRINIDAD, SANTA FE, and all principal points in

Old and New Mexico and Arizona.

☞ Connect at DENVER with the Colorado Central Railroad and Fast Concord Coaches, for Golden City, Black Hawk, Central City, Idaho City, Georgetown and Fair Play.

Passenger and Freight Rates as low and conveniences as ample as by any Route.

Ask for Tickets via KANSAS PACIFIC RAILWAY, which can be obtained at all principal ticket offices in the United States.

BEVERLY R. KEIM, Gen. Ticket Agt. Lawrence, Kansas. T. F. OAKES, Gen. Freight Agt. Kansas City, Mo. A. ANDERSON, Gen. Sup't. Lawrence, Kan.

FARMS AND HOMES IN KANSAS.

Five Million Acres of Choice Farming Lands, situated along the line of this Great National Route, at from one to six dollars per acre. For full particulars, apply to

JNO. P. DEVEREUX, Land Commissioner, Lawrence, Kan.

THE ERIE & PACIFIC DISPATCH CO.

Are Authorized Freight Agents.

For information, Contracts, and Bills of Lading, apply at their office, 64 Clark Street, Chicago.

H. H. RAPP, AGT.

Western Union Railroad.

CHICAGO & NORTHWESTERN DEPOT, CHICAGO. | MILWAUKEE & CHICAGO DEPOT, MILWAUKEE.

THE DIRECT ROUTE!

CHICAGO, RACINE & MILWAUKEE,

— TO —

Beloit, Savanna, Clinton, Pt. Byron, Davenport, Mineral Point, Madison, Freeport, Fulton, Lyons, Rock Island, Sabula, Galena, Dubuque, Des Moines, Council Bluffs,

OMAHA, SAN FRANCISCO

AND ALL PRINCIPAL POINTS IN

Southern and Central Wisconsin, Northern Illinois, and Central and Northern Iowa.

FRED. WILD, Gen. Ticket Agent.

D. A. OLIN, Gen. Superintendent.

THE FAVORITE THROUGH PASSENGER ROUTE!

Chicago, Burlington & Quincy
RAILROAD LINE.

3 THROUGH EXPRESS TRAINS DAILY!

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
TO OMAHA, - - -	23	$20.00	TO DENVER, - -	2½	$63.00
" ST. JOSEPH, - -	21	19.50	" SACRAMENTO, -	4½	118.00
" KANSAS CITY, -	22	20.00	" SAN FRANCISCO,	5	118.00

TRAINS LEAVE CHICAGO from the Great Central Depot, foot of Lake Street, as follows:

BURLINGTON, KEOKUK, COUNCIL BLUFFS & OMAHA LINE

7:40 A. M. MAIL AND EXPRESS, (Except Sunday,) stopping at all stations; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Galena, Dunleith, Dubuque, LaSalle, El Paso, Bloomington, &c.

10:45 A. M. PACIFIC FAST LINE, (Except Sunday,) stopping at Riverside, Hinsdale, Aurora, Leland, Mendota, Princeton, Buda, Kewanee, Galva, Galesburg, and all stations West and South of Galesburg.
☞ ELEGANT DAY COACHES and PULLMAN PALACE DRAWING ROOM CARS are attached to this train daily from Chicago

TO COUNCIL BLUFFS & OMAHA WITHOUT CHANGE!

9.00 P. M. PACIFIC NIGHT EXPRESS, (Daily, except Saturday,) for Burlington, Ottumwa, DesMoines, Nebraska City, Council Bluffs, Omaha, and all points West. **Pullman Drawing Room Sleeping Car** attached to this Train daily from **Chicago to Burlington,** and Elegant Day Coaches, from **Chicago to Council Bluffs and Omaha, without change!** This is the Route between

CHICAGO, COUNCIL BLUFFS & OMAHA,

—RUNNING THE CELEBRATED—

Pullman Palace Dining Cars!

49 MILES THE SHORTEST ROUTE BETWEEN

Chicago & Keokuk,

And the Only Route Without Ferrying the Mississippi River!

QUINCY, ST. JOSEPH, LEAVENW'TH & KANSAS CITY LINE.

7.40 A. M. MAIL AND EXPRESS (Except Sunday,) stopping at all stations between Chicago and Galesburg; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Dunleith, Dubuque, La Salle, El Paso, Bloomington, &c.

10:45 A. M. PACIFIC EXPRESS, (Daily, except Sunday,) with ELEGANT DAY COACHES and PULLMAN'S PALACE SLEEPING CARS attached, running through from Chicago to KANSAS CITY, **Without Change!**

9:00 P. M. PACIFIC NIGHT EXPRESS, (Daily,) with **Pullman Palace Drawing Room Sleeping Car** attached running through from Chicago to QUINCY,

Kansas City, Lawrence, Topeka and Denver,

☞ WITHOUT CHANGE! ☜

64 MILES THE SHORTEST AND ONLY ROUTE BETWEEN

Chicago and Kansas City!

WITHOUT CHANGE OF CARS OR FERRY.

115 MILES The Shortest Route bet. Chicago & St. Joseph.

THE SHORTEST, BEST AND QUICKEST ROUTE BETWEEN CHICAGO AND

Atchison, Weston, Leavenworth, Lawrence,

AND ALL POINTS ON THE KANSAS PACIFIC R'Y.

Local Trains Leave

RIVERSIDE & HINSDALE ACCOMMODATION	7:00 A. M. 1:30 & 6:15 P. M
GALESBURG PASSENGER	3:00 P. M.
MENDOTA PASSENGER	4:15 P. M.
AURORA PASSENGER	5:30 P. M.

Ask for Tickets via Chicago, Burlington & Quincy Railroad, which can be obtained at all principal offices of connecting roads, at Company's office, 63 Clark Street, and at Great Central Depot, Chicago at as low rates as by any other route.

ROB'T HARRIS, Gen'l Superintendent, CHICAGO.
SAM'L POWELL, Gen'l Ticket Agent, CHICAGO.
E. A. PARKER, Gen. West. Pass. Agt., CHICAGO.

THE GREAT THROUGH PASSENGER ROUTE TO KANSAS

IS VIA THE OLD RELIABLE

HANNIBAL & ST. JOSEPH
SHORT LINE.

Crossing the Mississippi at Quincy and the Missouri at Kansas City on New Iron Bridges; running Three Daily Express Trains, Through Cars and Pullman Sleeping Palaces from Chicago & Quincy to St. Joseph & Kansas City.

The Advantages gained by this Line over any other Route from Chicago, are:

115 MILES THE SHORTEST!

To St. Joseph, Atchison, Hiawatha, Waterville, Weston, Leavenworth,

64 MILES THE SHORTEST!

To Kansas City, Fort Scott, Lawrence, Ottawa,

Garnett, Iola, Humboldt, Topeka, Burlingame, Emporia, Manhattan, Fort Riley, Junction City, Salina, Ellsworth, Hays, Sheridan, Olathe, Paola, Cherokee Neutral Lands, Baxter Springs, Santa Fe, New Mexico, and all Points on the KANSAS PACIFIC, and MISSOURI RIVER, FT. SCOTT & GULF R. R's, with which we connect at Kansas City Union Depot.

THIS BEING THE SHORTEST LINE AND QUICKEST, is consequently the cheapest; and no one that is posted thinks of taking any other Route from Chicago to reach principal points in

Missouri, Kansas, Indian Territory, or New Mexico.

DAILY OVERLAND STAGES from west end Kansas Pacific Railway, for Pueblo, Santa Fe, Denver, and points in Colorado and New Mexico.

THIS is also a most desirable Route, via St. Joseph, to Brownsville, Nebraska City, Council Bluffs, and Omaha, connecting with the Union Pacific Railroad for Cheyenne, Denver, Salt Lake, Sacramento, San Francisco, and the Pacific coast.

Through Tickets for Sale at all Ticket Offices. Baggage Checked Through, and Omnibus Transfers and Ferriage avoided.

P. B. GROAT, Gen. Ticket Agent. HANNIBAL, MO
GEO. H. NETTLETON, Gen. Supt. HANNIBAL, MO.

Old, Reliable, Air-Line Route!

CHICAGO, ALTON & ST. LOUIS R. R.

SHORTEST, QUICKEST AND ONLY DIRECT ROAD TO

Bloomington, Springfield, Jacksonville, Alton,

— AND —

ST. LOUIS!

WITHOUT CHANGE OF CARS.

THE ONLY ROAD MAKING IMMEDIATE CONNECTIONS AT ST. LOUIS WITH MORNING AND EVENING TRAINS

—FOR—

ATCHISON, LEAVENWORTH, KANSAS CITY,

Lawrence, Topeka, Memphis, New Orleans,

And All Points South and Southwest.

☞ TRAINS leave CHICAGO from the West-side Union Depot, near Madison Street Bridge. ☜

	Depart.	Arrive.
EXPRESS MAIL	*9:15 A. M.	*8:05 P. M.
JOLIET ACCOMMODATION	*4:00 P. M.	*9:40 A. M.
NIGHT EXPRESS	†5:30 "	*12:50 P. M.
LIGHTNING EXPRESS	‡9:00 "	*7:30 A. M.

*Sundays excepted.
†Daily; Saturdays it runs to Bloomington only.
‡Saturdays and Sundays excepted. Monday mornings this train runs from Bloomington to St. Louis.

This is the ONLY LINE Between CHICAGO & ST. LOUIS RUNNING

Pullman's Palace Sleeping and Celebrated Dining Cars!

BAGGAGE CHECKED THROUGH.

Through Tickets can be had at the Company's office, No. 55 Dearborn street, Chicago, or at the Depot, corner of West Madison and Canal streets, and at all principal Ticket Offices in the United States and Canada. Rates of Fare and Freights as low as by any other Route.

A. NEWMAN, Gen. Pass. Agent. **J. C. McMULLIN, Gen. Supt.**

Pacific Railroad of Missouri.

THE MOST DIRECT AND RELIABLE ROUTE FROM ST. LOUIS THROUGH TO

KANSAS CITY, LEAVENWORTH & ATCHISON,

☞ WITHOUT CHANGE OF CARS! ☜

Close Connections at KANSAS CITY with Missouri Valley, Missouri River, Ft. Scott & Gulf, and Kansas Pacific R'ys, for Weston, St. Joseph, Junction City, Fort Scott, Lawrence, Topeka, Sheridan, Denver, Fort Union, Santa Fe, and

ALL POINTS WEST!

☞ At SEDALIA, WARRENSBURG and PLEASANT HILL, with Stage Lines for Warsaw, Quincy, Bolivar, Springfield, Clinton, Osceola, Lamar, Carthage, Granby, Neosho, Baxter Springs, Fort Gibson, Fort Smith, Van Buren, Fayetteville, Bentonville.

PALACE SLEEPING CARS on all NIGHT TRAINS.

Baggage Checked Through Free!

THROUGH TICKETS for sale at all the Principal Railroad Offices in the United States and Canadas. **Be Sure and Get your Tickets over the PACIFIC R. R. OF MISSOURI.**

W. B. HALE, Gen. Pass. and Ticket Agt.
THOS. McKISSOCK, General Superintendent.

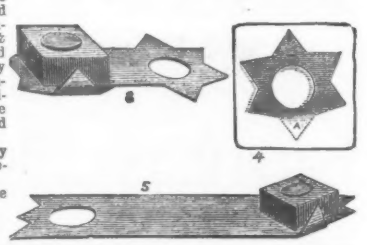
THE UNION PATENT STOP WASHER,

Manufactured at Coatesville, Chester Co., Pa., on the line of the Pennsylvania Central R. R., has now stood the test of practical use on the above road, the Philaphia, Wilmington & Baltimore and Philadelphia & Reading Railroads, for the past two years, and proved itself to be what is claimed for it—a perfect security against the unscrewing or receding of nuts. Its simplicity, efficiency and cheapness over any other appliance for the purpose should recommend it to the attention of all persons having charge of Railroad tracks, cars and machinery.

It is especially adapted to, and extensively used by leading Railroads of the country for the purpose of securing nuts on railway joints.

The accompanying cuts show the application of the Washer. For further information, apply to

A. GIBBONS, Coatesville, Pa.



PITTSBURGH CAST STEEL SPRING WORKS.

A. French & Co.,

Manufacturers of Extra Tempered, Light Elliptic

CAST STEEL SPRINGS,

FOR RAILROAD CARS AND LOCOMOTIVES,

FROM BEST CAST STEEL.

OFFICE AND WORKS:—Cor. Liberty and 21st Sts., PITTSBURGH, PA.

ST. LOUIS BRANCH, M. M. BUCK & CO. | **CHICAGO BRANCH, 88 Michigan Ave**

ILLINOIS CENTRAL RAILROAD.

PASSENGER TRAINS LEAVE CHICAGO FROM THE GREAT CENTRAL DEPOT, FOOT OF LAKE ST.

ST. LOUIS AND CHICAGO
THROUGH LINE.

No Change of Cars from Chicago to St. Louis.

9:20 A. M. DAY EXPRESS Sundays Ex.
Arriving in ST. LOUIS at 10:30 P. M.

8:15 P. M. FAST LINE. Saturdays Excepted.
Arriving at ST. LOUIS at 8:00 A. M.

AT ST. LOUIS, Direct Connections are Made FOR

Jefferson City, Sedalia, Pleasant Hill, Macon, Kansas City,

LEAVENWORTH, ST. JOSEPH & ATCHISON,

—Connecting at KANSAS CITY for—

LAWRENCE, TOPEKA, JUNCTION CITY, SALINA, SHERIDAN,

Denver and San Francisco!

CAIRO, MEMPHIS AND NEW ORLEANS LINE.

No Change of Cars from Chicago to Cairo.

9:20 A. M. CAIRO MAIL, Sundays Excepted.
Arriving at **Cairo** 2:05 A. M., **Memphis** 12:45 P. M., **Mobile** 9:25 A. M. **Vicksburg** 9:25 A. M., **New Orleans** 11:05 A. M.

8:15 P. M. CAIRO EXPRESS, Except Saturdays.
Arriving at **Cairo** 12:24 P. M., **Memphis** 4:15 A. M., **Little Rock** 7:00 P. M., **Vicksburg** 8:10 P. M., **New Orleans** 1:30 A. M.

4:50 P. M. CHAMPAIGN PASSENGER,
Arriving at **Champaign** at 10:45 P. M.

☞ THIS IS THE ONLY DIRECT ROUTE TO

Humboldt, Corinth, Grand Junction, Little Rock, Hot Springs, Selma, Canton, Grenada, Columbus, Meridian, Enterprise,

MEMPHIS, VICKSBURG, NEW ORLEANS & MOBILE.

At NEW ORLEANS, connections are made for

GALVESTON, INDIANOLA,

And all Parts of Texas.

☞ **NOTICE.—This Route is from 100 to 150 MILES SHORTER, and from 12 to 24 HOURS QUICKER than any other.**

THIS IS ALSO THE ONLY DIRECT ROUTE TO

DECATUR, TERRE HAUTE, VINCENNES & EVANSVILLE.

Peoria and Keokuk Line.

9:20 A. M. KEOKUK PASSENGER, Sun. Excepted.
Arriving at **Chenoa** 3:20 P. M., **El Paso** 4:08 P. M., **Peoria** 5:43 P. M., **Canton** 7:15 P. M., **Bushnell** 8:57 P. M., **Keokuk** 11:15 P. M., **Warsaw** 11:40 A. M.

Elegant Drawing Room Sleeping Cars

ATTACHED TO ALL NIGHT TRAINS.

Spacious and Fine Saloon Cars!

WITH ALL MODERN IMPROVEMENTS, RUN UPON ALL TRAINS.

BAGGAGE CHECKED THROUGH TO ALL IMPORTANT POINTS.

☞ For Through Tickets, Sleeping Car Berths, Baggage Checks, and information, apply at the office of the Company in the Great Central Depot, foot of Lake St.

Hyde Park and Oakwoods Train.

	LEAVE.	ARRIVE.		LEAVE.	ARRIVE.
HYDE PARK TRAIN,...	*6:20 A. M.	*7.45 A. M.	HYDE PARK TRAIN,....	*3:00 P. M.	*5:15 P. M
HYDE PARK TRAIN...	*8:00 A. M.	*9.20 A. M.	HYDE PARK TRAIN,....	*6:10 P. M.	*7:35 P. M
HYDE PARK TRAIN,..	*12:10 P. M.	*1:45 P. M.			

* Sundays Excepted.

W. P. JOHNSON, Gen. Pass. Agent.

CHICAGO & NORTHWESTERN R. W.

Comprising the PRINCIPAL RAILROADS from CHICAGO Directly NORTH NORTH-WEST and WEST.

ALL RAIL TO THE PACIFIC OCEAN!

Great California Line.

TRAINS LEAVE WELLS STREET DEPOT AS FOLLOWS:

8:30 A. M. Clinton Passenger. | **10:00 P. M.** Night Mail.
10:45 A. M. Pacific Express. | **10:00 P. M.** Rock Island Pass.
10:45 A. M. Rock Island Exp. | **4:00 P. M.** Dixon Passenger.

For Sterling, Rock Island, Fulton, Clinton. Cedar Rapids, Boone, Denison, Missouri Valley Junction, Sioux City, Council Bluffs and Omaha, there connecting with the

UNION PACIFIC R. R.

For Cheyenne, Denver, Ogden, Salt Lake, the White Pine Silver Mines, Sacramento, San Francisco, and all parts of Nebraska, Colorado, New Mexico, Arizona, Wyoming, Montana, Idaho, Utah, Nevada, and the PACIFIC COAST.

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
To OMAHA,.....	23	$20.00	To SACRAMENTO,.	4½	$118.00
" DENVER,.....	52	65.00	" SAN FRANCISCO,	5	118.00

TRAINS ARRIVE:—Night Mail, **7.15** a. m.; Dixon Passenger, **11.10** a. m.; Pacific Express **4:15** p. m.; Rock Island Express, **4:15** p. m.; Clinton Passenger, **6:45** p. m.

FREEPORT LINE.

9.00 A. M. & 9.00 P. M. For Belvidere, Rockford, Freeport, Galena, Dunleith, and St. Paul.

4.00 P. M., Rockford Accommodation.
5.30 P. M., Geneva and Elgin Accommodation
6.10 P. M., Lombard Accommodation.
5:50 P. M., Junction Passenger.

TRAINS ARRIVE:—Freeport Passenger, **2:30** p. m., **6:40** a. m.; Rockford Accommodation **11:10** a. m.; Geneva and Elgin Accommodation, **8:45** a. m.; Junction Passenger, **8:10** a. m.; Lombard Accommodation, **6:50** a. m.

WISCONSIN DIVISION.

☞ Trains leave Depot, cor. West Water and Kinzie Sts., daily, Sundays excepted, as follows:

10.00 A. M. **DAY EXPRESS,** for Janesville, Monroe, Whitewater, Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Neenah, Appleton, and Green Bay.

3.00 P. M., Janesville Accommodation.

5.00 P. M. **NIGHT EXPRESS,** for Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Menasha, Appleton, Green Bay, and THE LAKE SUPERIOR COUNTRY.

5.30 P. M., Woodstock Accommodation.

TRAINS ARRIVE:—**7:00** a. m., **7:15** p. m., **9:00** a. m., and **2:05** p. m.

MILWAUKEE DIVISION.

MILWAUKEE MAIL,	8:15 A. M.
EXPRESS, (ex. Sun.) Waukegan, Kenosha, Racine and Milwaukee,	9:45 A. M.
EVANSTON ACCOMMODATION,	1:00 P. M.
HIGHLAND PARK PASSENGER,	6:20 P. M.
MILWAUKEE ACCOMMODATION, with Sleeping Car attached	11:00 P. M.
KENOSHA ACCOMMODATION, (Sundays excepted) from Wells St. Depot	4:10 P. M.
AFTERNOON PASSENGER,	5:00 P. M.
WAUKEGAN ACCOMMODATION, (except Sundays) from Wells St. Depot	5:30 P. M.

TRAINS ARRIVE:—Night Accommodation, with Sleeping Car, **5:00** a. m.; Day Express, **4:15** p. m. Milwaukee Mail, **10:30** a. m.; Afternoon Passenger, **7:40** p. m.; Waukegan Accommodation, **8:25** a. m.; Kenosha Accommodation, **9:10** a. m.; Evanston Accommodation, **3.30** p. m.; Highland Park Passenger, **7.55** p. m.

PULLMAN PALACE CARS ON ALL NIGHT TRAINS.

THROUGH TICKETS Can be purchased at all principal Railroad Offices East and South, and in Chicago at the Southeast corner of Lake and Clark Streets, and at the Passenger Stations as above.

H. P. STANWOOD, Gen. Ticket Agt.
JOHN C. GAULT, Gen'l Supt.

Milwaukee & St. Paul R. W.

THE ONLY ALL RAIL LINE TO

ST. PAUL AND MINNEAPOLIS!

AND ALL PORTIONS OF

Wisconsin, Minnesota & Northern Iowa.

PURCHASE TICKETS VIA MILWAUKEE.

Passengers Going via Milwaukee,

Have Choice of Seats in Clean Coaches, and on Night Trains, a full night's rest in Palace Sleeping Cars.

☞ BAGGAGE CHECKED THROUGH BY THIS ROUTE ONLY! ☜

PASSENGERS FROM CHICAGO can obtain these Advantages only by the MILWAUKEE DIVISION of the CHICAGO & NORTHWESTERN R'Y.

SPECIAL NOTICE.—Passengers destined to any place in Wisconsin, Minnesota, or Northern Iowa, either on or off the Lines of this Company, who cannot procure Through Tickets to their destination, should purchase their Tickets **TO MILWAUKEE,** as this is the Great Distributing Point for these States.

A. V. H. CARPENTER, Gen. Pass. Agt. Milwaukee.
S. S. MERRILL, Gen. Manager, Milwaukee

61 Miles the Shortest Line!

— FROM —

CHICAGO TO NEW YORK.

Pitts., Ft. Wayne & Chicago

— AND —

PENNSYLVANIA CENTRAL

IS THE ONLY ROUTE

Running its Entire Trains THROUGH to Philadelphia and New York, and the only Route running Three Daily Lines of Pullman Day and Sleeping Palaces, from Chicago to

PITTSBURGH, HARRISBURG,

PHILADELPHIA & NEW YORK,

☞ WITHOUT CHANGE! ☜

WITH BUT ONE CHANGE TO

BALTIMORE, PROVIDENCE, NEW HAVEN, HARTFORD, SPRINGFIELD, WORCESTER & BOSTON!

AND THE MOST DIRECT ROUTE TO WASHINGTON.

☞ Trains Leave WEST SIDE UNION DEPOT, corner West Madison and Canal Streets, as follows:

		Mail.	Fast Express.	Pacific Exp.	Night Exp.
Leave—	CHICAGO	5.30 A. M.	9.00 A. M.	5.15 P. M.	9.00 P. M.
Arrive—	PLYMOUTH	9.50 "	12.03 P. M.	8.45 "	12.35 A. M.
"	FORT WAYNE	12.30 P. M.	2.05 "	11.15 "	3.10 "
"	LIMA	3.34 "	4.06 "	1.23 A. M.	5.40 "
"	FOREST	4.43 "	5.08 "	2.45 "	7.07 "
"	CRESTLINE	6.20 "	6.30 "	4.20 "	8.55 "
Leave—	CRESTLINE	6.00 A. M.	6.50 "	4.30 "	9.35 "
Arrive—	MANSFIELD	6.40 "	7.17 "	5.00 "	10.06 "
"	ORRVILLE	9.15 "	9.05 "	6.54 "	11.55 "
"	ALLIANCE	11.10 "	10.40 "	8.30 "	1.30 P. M.
"	PITTSBURGH	3.45 P. M.	1.55 A. M.	12.10 P. M.	4.40 "
"	CRESSON	11.57 "	5.44 "	4.48 "	10.00 "
"	ALTOONA	12.48 A. M.	6.55 "	5.55 "	2.40 A. M.
"	HARRISBURG	5.30 "	11.25 "	10.45 "	2.50 "
"	PHILADELPHIA	6.50 "	3.15 "	3.00 "	6.50 "
"	NEW YORK, VIA PHILADELPHIA	10.30 "	6.30 "	6.41 "	10.30 "
"	NEW YORK, VIA ALLENTOWN	10.30 "	6.30 "	.....	10.30 "
"	BALTIMORE	9.15 P. M.	3.05 "	2.30 A. M.	9.15 P. M.
"	WASHINGTON	1.00 "	5.15 "	5.45 "	1.00 "
"	BOSTON	9.00 "	5.50 A. M.	6.00 "	9.00 "

Boston and New England Passengers will find this Route especially Desirable, as it gives them an opportunity of Seeing the FINEST VIEWS AMONG THE ALLEGHANY MOUNTAINS,

Besides Visiting PITTSBURGH, PHILADELPHIA and NEW YORK, without extra cost!

☞ All New England Passengers holding Through Tickets will be Transferred, with their Baggage, to Rail and Boat Connections in NEW YORK, **Without Charge!**

THROUGH TICKETS for sale at the Company's Offices, at 65 Clark St.; 52 Clark St.; cor. Randolph and LaSalle Sts.; and at Depot, Chicago. Also at Principal Ticket Offices in the West.

CLOSE CONNECTIONS Made at LIMA for all Points on the Dayton & Michigan and the Cincinnati, Hamilton & Dayton Railways, and at CRESTLINE for Cleveland and Columbus.

Express Trains are Equipped with WESTINGHOUSE AIR BRAKES,

The Most Perfect Protection Against Accidents in the World!

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T. L. KIMBALL, Gen. Western Pass. Agt. Penn. Cen. R. R. Chicago.

Broad Gauge! Double Track!

ERIE RAILWAY.

4 EXPRESS TRAINS DAILY!

From Cleveland, Dunkirk and Buffalo, 625 Miles, to New York, WITHOUT CHANGE of Coaches!

☞ The Trains of this Railway are run in DIRECT CONNECTION WITH ALL WESTERN AND SOUTHERN LINES, for

Elmira, Williamsport, Oswego, Great Bend, Scranton, Newburgh,

NEW YORK, ALBANY, BOSTON, PROVIDENCE,

AND PRINCIPAL NEW ENGLAND CITIES.

New and Improved DRAWING ROOM COACHES are attached to the DAY EXPRESS Running THROUGH TO NEW YORK.

☞ **SLEEPING COACHES,** Combining all Modern Improvements, with perfect Ventilation and the peculiar arrangements for the comfort of Passengers incident to the **BROAD GAUGE,** accompany all night trains to New York.

CONNECTIONS CERTAIN! as Trains on this Railway will, when necessary, **wait from one to two hours for Western trains.**

All Trains of Saturday run directly Through to New York.

☞ **Ask for Tickets via Erie Railway,** which can be procured at **66 Clark Stree** Chicago, and at all Principal Ticket offices in the West and Southwest.

L. D. RUCKER, General Superintendent, New York. | **A. J. DAY,** Western Passenger Agent, Chicago. | **WM. R. BARR,** Gen'l Passenger Agent, New York

Pan-Handle

— AND —

Penn'a Central Route East!

☞ SHORTEST AND QUICKEST ROUTE, VIA COLUMBUS, TO ☜

PITTSBURGH, BALTIMORE, PHILADELPHIA & NEW YORK

On and after Sunday, NOVEMBER 20th, 1870, Trains for the East will run as follows:

[DEPOT CORNER CANAL AND KINZIE STS., WEST SIDE.]

7:40 A. M. DAY EXPRESS. [SUNDAYS EXCEPTED.] Via Richmond. Arriving at

COLUMBUS	3:00 A. M.	HARRISBURG	10:35 P. M.	NEW YORK	6:40 A. M.	WASHINGTON	5:45 A. M
PITTSBURGH	12:15 M.	PHILADELPHIA	3:10 A. M.	BALTIMORE	2:30 A. M.	BOSTON	5:05 P. M

7:10 P. M. NIGHT EXPRESS. [SUNDAYS EXCEPTED.] Arriving at:

COLUMBUS	11:15 A. M.	HARRISBURG	5:20 A. M.	NEW YORK	11:40 A. M.	WASHINGTON	1:10 P. M
PITTSBURGH	7:25 P. M.	PHILADELPHIA	9.50 A. M.	BALTIMORE	9:30 A. M.	BOSTON	11:50 P. M

Palace Day and Sleeping Cars

Run Through to COLUMBUS, and from Columbus to NEW YORK, WITHOUT CHANGE!

ONLY ONE CHANGE TO NEW YORK, PHILADELPHIA, OR BALTIMORE!

CINCINNATI & LOUISVILLE AIR LINE SOUTH.

35 Miles the Shortest Route to Cincinnati.

18 Miles the Shortest Route to Indianapolis and Louisville

3 Hours the Quickest Route to Cincinnati!

THE SHORTEST AND BEST ROUTE TO

Columbus, Chillicothe, Dayton, Hamilton, Zanesville, Wheeling, Marietta, Parkersburg, Lexington, Evansville, Terre Haute, Nashville,

ALL POINTS IN CENTRAL & SOUTHERN OHIO, & INDIANA, KENTUCKY & VIRGINIA.

— QUICK, DIRECT AND ONLY ALL RAIL ROUTE TO —

New Orleans, Memphis, Mobile, Vicksburg, Charleston, Savannah,

AND ALL POINTS SOUTH.

Cincinnati, Indianapolis and Louisville Trains run as follows:

THROUGH WITHOUT CHANGE OF CARS!

7.40 A. M. (Sundays excepted) Arriving at

LOGANSPORT	1:15 P. M.
KOKOMO	2:38 P. M.
CINCINNATI	10:10 P. M.
INDIANAPOLIS	5:00 P. M.
LOUISVILLE	11:30 P. M.

8.05 P. M. (Saturdays excepted.) Arriving at

LOGANSPORT	1:15 A. M.
KOKOMO	2:31 A. M.
CINCINNATI	9:35 A. M.
INDIANAPOLIS	5:40 A. M.
LOUISVILLE	3:50 P. M

Lansing Accommodation: Leaves 3:40 P. M. Arrives 10:55 A. M.

PULLMAN'S PALACE SLEEPING CARS!

Accompany all Night Trains between Chicago and Cincinnati or Indianapolis.

☞ Ask for Tickets **via COLUMBUS** for the East, and **via "The AIR LINE"** for Cincinnati, Indianapolis, Louisville and points South. Tickets for sale and Sleeping Car Berths secured at **95 RANDOLPH STREET, CHICAGO,** and at Principal Ticket Offices in the West and Northwest.

WM. L. O'BRIEN, Gen. Pass. and Ticket Agent, Columbus. | **I. S. HODSDON** Northwestern Pass. Agt. Chicago

D. W. CALDWELL Gen Supt. Columbus.

The Great Favorite Route for Missouri, Nebraska and Iowa.

KANSAS CITY, ST. JOSEPH

— AND —

COUNCIL BLUFFS

☞ THROUGH LINE! ☜

3 EXPRESS PASSENGER TRAINS Leave Union Depot Daily, on the arrival of Eastern Southern and Western Trains, crossing the Missouri River on the New Iron Bridge at KANSAS CITY, passing the cities of

LEAVENWORTH, ATCHISON, SAINT JOSEPH,

— AND —

NEBRASKA CITY.

Connecting at COUNCIL BLUFFS with Iowa Lines for all prominent points in Iowa, and making DIRECT CONNECTION at **OMAHA** with the Great **Union Pacific Railroad,** for

CHEYENNE, DENVER, SALT LAKE, SACRAMENTO, SAN FRANCISCO

And the Pacific Coast.

Pullman's Palace Sleeping Cars!

ON ALL NIGHT TRAINS.

☞ Ask for Tickets via the People's Favorite Route, **Kansas City, St. Joseph & Council Bluffs Railroad Line.**

A. L. HOPKINS, Gen. Superintendent ST. JOSEPH, Mo. | **A. C. DAWES,** Gen. Passenger Agent, ST. JOSEPH, Mo.

LAKE SHORE
— AND —
MICHIGAN SOUTHERN R.W.

THE GREAT THROUGH LINE BETWEEN

CHICAGO, BUFFALO & NEW YORK,

WITHOUT CHANGE!

AND THE ONLY RAILWAY

RUNNING PALACE COACHES THROUGH!

— BETWEEN —

CHICAGO & NEW YORK, via BUFFALO

☞ WITHOUT TRANSFER OF PASSENGERS! ☜

All Trains Stop at Twenty-Second Street to Take and Leave Passengers. Baggage Checked at that Station for all Points East.

4 EXPRESS TRAINS DAILY, [Sundays Excepted,] Leave CHICAGO from the New Depot, on Van Buren St., at the head of La Salle Street, as follow

5:30 A. M. MAIL TRAIN.
VIA OLD ROAD AND AIR LINE. SUNDAYS EXCEPTED.

Leaves 23d Street 7:45 A. M. Stops at all Stations. **Arrives**—Cleveland, 9:35 P. M.

9:00 A. M. SPECIAL NEW YORK EXPRESS,
VIA AIR LINE. SUNDAYS EXCEPTED.

Leaves—Twenty-Second Street, **9:15 A. M. Arrives**—Elkhart, 12:45 P. M.; Cleveland 9:45 P M.; Buffalo, 4:10 A. M.; New York, 7:00 P. M.; (Chicago Time) Boston, 11:45 P. M.

This Train has PALACE SLEEPING COACH Attached, Running

THROUGH TO ROCHESTER, WITHOUT CHANGE!

IN DIRECT CONNECTION WITH

Wagner's Celebrated Drawing-Room Coaches on N. Y. Central R. R.

Only Thirty-Three Hours, Chicago to New York!

5:15 P. M. ATLANTIC EXPRESS (Daily).
VIA OLD ROAD.

Leaves—Twenty-Second Street **5:30 P. M. Arrives**—Laporte, 8:10 P. M. (Stops 20 minutes or Supper); arrives at Toledo, 2:50 A. M.; Cleveland, 7:25 A. M. (20 minutes for Breakfast); arrives at Buffalo, 1:50 P. M.; Rochester, 5:10 P. M. (20 minutes for Supper); connects with **Sleeping Coach running Through from Rochester to Boston Without Change,** making but **One Change between Chicago and Boston.**

NEW AND ELEGANT SLEEPING COACH Attached to this Train, Running THROUGH from CHICAGO TO NEW YORK WITHOUT CHANGE! Arrives at NEW YORK, 7:15 A. M.

9:00 P M. NIGHT EXPRESS
VIA AIR LINE. (DAILY EXCEPT SAT. & SUN.)

Leaves—Twenty-Second Street, **9:15 P. M. Arrives**—Toledo, 6:15 A. M. (20 minutes for Breakfast); arrives at Cleveland, 10:50 A. M.; Buffalo, 5:50 P. M.; New York, 12:00 M.; Boston, 3:50 P. M.

KALAMAZOO DIVISION.

Leave Chicago 9:00 A. M. Arrive at Kalamazoo 4:10 P. M.; Grand Rapids, 7:10 P. M.

Leave Chicago 9:00 P. M. Arrive at Kalamazoo 7:25 A. M.; Grand Rapids, 10:15 A. M.

☞ There being no heavy grades to overcome, or mountains to cross, the road bed nd track being the smoothest and most perfect of any railway in the United States, this Company run heir trains at a high rate of speed with perfect safety.

☞ Travelers who wish to SAVE TIME and make SURE CONNECTIONS, purchase Tickets via

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THE ONLY LINE RUNNING THROUGH BETWEEN CHICAGO AND BUFFALO, WITHOUT TRANSFER, and in Direct Connection with NEW YORK CENTRAL RAILROAD and ERIE RAILWAY.

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— AND —
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THE FAVORITE ROUTE, VIA NIAGARA FALLS, TO

NEW YORK, BOSTON,

AND ALL EASTERN POINTS.

Pullman's Drawing-Room Cars

FROM CHICAGO TO NEW YORK WITHOUT CHANGE.

CELEBRATED HOTEL CARS FROM CHICAGO TO ROCHESTER.

Passenger Trains leave Chicago from Depot, foot of Lake Street, as follows: (All Trains Stop at Twenty-Second Street Station to receive and leave Passengers.)

5:40 A. M. MAIL TRAIN, Sundays Excepted.
Has a car attached from Chicago going over both Main Line and Air Line Division, Without Change. Connect at New Buffalo for St. Joseph; at Jackson for Lansing, Saginaw and Bay City.

9:00 A. M. NEW YORK EXPRESS.
(SUNDAYS EXCEPTED.) Arrives at Michigan City at 11:10 A. M.; Niles, 12:20 P. M. [Dinner]; Kalamazoo, 2:10 P. M.; Marshall, 3:34 P. M.; Jackson, 4:30 P. M.; Detroit, 6:55 P. M. [Supper]; London, 11:25 A. M.; Hamilton, 2:35 A. M.; Niagara Falls, 4: A. M.; Rochester, 7:10 A. M. [Breakfast]; Albany, 2:00 P. M.; NEW YORK, **7:00 P. M.**; Springfield, 7:40 P. M.; BOSTON, **11:45 P. M.** This Train connects at ROCHESTER with

Wagner's Drawing Room Car through to New York without change!

Connects at Kalamazoo direct for Grand Rapids, Muskegon, Whitehall, &c., &c.

9:30 A. M. CINCINNATI & LOUISVILLE EXPRESS
(SUNDAYS EXCEPTED.) **Through Cars to Indianapolis and Cincinnati without Change.**

4:10 P. M. Kalamazoo, St. Joseph and Three Rivers Accom.
(SUNDAYS EXCEPTED.) Arrives at New Buffalo at 7:05 P. M.; St. Joseph, 8:40 P. M.; Kalamazoo, 1:05 P. M.; Three Rivers, 10:00 P. M.

5:15 P. M. ATLANTIC EXPRESS.
Leaves Daily. ☞ Arrives at Michigan City at 7:18 P. M.; Niles, 8:30 P. M. [Supper]; Kalamazoo, 10:40 P. M.; Jackson, 1:10 A. M.; Detroit, 3:45 A. M.; London, 8:35 A. M. [Breakfast]; Hamilton, 11:40 A. M.; Niagara Falls, 1:30 P. M.; Buffalo, 3:20 P. M.; Rochester, 5:10 P. M.; Albany, 1:30 A. M.; NEW YORK, **6:40 A. M.**; Springfield, 6:40 A. M.; BOSTON **11:00 A. M.** A MAGNIFICENT

PULLMAN DRAWING-ROOM SLEEPING CAR

IS ATTACHED TO THIS TRAIN DAILY, FROM

CHICAGO TO NEW YORK CITY.

☞ The Celebrated **HOTEL CAR** is also Attached to this Train from **CHICAGO** to **ROCHESTER.**

☞ **SPECIAL NOTICE.**—Boston and New England Passengers will please notice that thi Train now makes a direct connection through. A **Sleeping Car** is attached at Rochester at 5:30 P. M., running through to Springfield, Mass., thus avoiding transfer at Albany. Breakfast at Springfield. This Train reaches Springfield early enough second morning to CONNECT WITH ALL TRAINS up and down the Connecticut

6:30 P. M. CINCINNATI & LOUISVILLE EXPRESS
(SATURDAYS EXCEPTED.) **Through Sleeping Cars to Louisville without Change.**

This is the Only Line Running Sleeping Cars to Louisville!

9:00 P. M. NIGHT EXPRESS. Saturdays and Sundays Excepted
☞ Arrives at Michigan City at 11:03 P. M.; Niles, 12:25 A. M.; Kalamazoo, 2:00; Marshall, 3:12; Jackson, 4:25; Grand Trunk Junction, 7:00; Detroit, 7:45; London, 1:45 P. M.; Hamilton, 4:35; Toronto, 9:35; Niagara Falls, 5:40; Buffalo, 7:15 P. M.; Rochester, 9:10; Syracuse, 12:25 A. M.; Rome, 1:55; Utica, 3:25; Albany, 6:30 A. M.; NEW YORK, **12:00 M.**; BOSTON, **3:30 P. M.**

A PULLMAN PALACE SLEEPING CAR

Is attached to this Train for **DETROIT.** This Train connects at **DETROIT JUNCTION** with **Grand Trunk Railway** for

MONTREAL, OGDENSBURG, &c.

9:00 P. M. Grand Rapids Express.
(SATURDAYS AND SUNDAYS EXCEPTED.) Arrives at Grand Rapids at 9:50 A. M.

An Elegant Pullman Sleeping Car

IS ATTACHED TO THIS TRAIN

THROUGH TO GRAND RAPIDS WITHOUT CHANGE!

Connecting there Direct to MUSKEGON, WHITEHALL, &c., &c.,

SPECIAL NOTICE.—The GREAT WESTERN RAILWAY of Canada have during the past summer, put down 140 miles of New Rail, (a large proportion of the same being Steel Rails,) and otherwise improved their track, so that it can be truly said that it is in as good condition as any Line in the country.

☞ **Through Tickets** (and secured accommodations in Drawing-Room Sleeping Cars) can be purchased in Chicago at 60 Clark street (under Sherman House); at 48 Clark street (Grand Trunk Railway); at 53 Clark street (N. Y. C. R. R.); at office under Briggs House; at Great Central Depot, and at

General Office in Tremont House Block.

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Gen. Sup't M. C. R. R.

W. K. MUIR,
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NOTICES OF THE PRESS.

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"A very neat publication in point of appearance, and, as it always has been, is now a reliable, interesting and accurate journal, ably edited in its various departments. * * Our scissors have wandered over its columns "many a time and oft," and always with gratifying results."—[Buffalo Commercial Advertiser

"Has been for thirteen years a live, energetic railroad newspaper, and has fought its way up among its many competitors for the favor of the railroad public, gaining in strength and rising in importance year by year, until to-day it stands second to no journal of that important class in the United States."—[Peoria Daily Transcript.

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